DRAINAGE CALCULATIONS
AND
STORMWATER MANAGEMENT PLAN

For The

Proposed Mixed-Use Development

located at

39 & 41 Hillside Avenue
(Tax Map 76 Lots 60 & 61)
Amesbury, Massachusetts

Submitted to:
City of Amesbury
City Hall
62 Friend Street
Amesbury, MA 01913

Prepared for:
Angiolillo Management Group Inc.
99 Walnut Street
Saugus, MA 01906

Prepared by

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October 26, 2021

Table of Contents

Proposed Mixed-Use Development
39 & 41 Hillside Avenue
Amesbury, MA 01913

Project Description

The project consists of the demolition of the existing structures (former automotive building and shed) and the construction of the proposed mixed-use building with driveway, parking area and landscaping. The subject property is comprised of approximately 23,717 S.F. of land and is located at 39 & 41 Hillside Avenue in Amesbury, MA (Tax Map 76 Lots 60 & 61). The property currently consists of a former automotive garage and shed with asphalt drive way and parking area.

The proposed project consists of the construction of the mixed used development with proposed bituminous concrete driveway and parking area, landscaped areas, incidental site grading, utility connection and stormwater management system.

The site abuts residential land to the north, west and south and Hillside Avenue to the east. Frontage and access are provided via Hillside Avenue.

Site Description

The subject property is currently occupied by a vacant automotive garage, a shed, asphalt parking area and landscaping. The topography of the site is general flat with slopes up to 4%. The site has a well-defined drainage pattern with storm runoff draining in a northeasterly direction towards Hillside Avenue. The majority of the site is comprised of impervious areas including the existing garage and asphalt parking area. The site does not contain any storm water management facilities in the pre-development condition. As a result, storm water runoff flows un-mitigated towards the design point.

In the proposed condition, the groundcover of the site will consist of the proposed mixed-use development, driveway and parking area and increased landscaped areas. In order to mitigate the stormwater runoff generated by the site, infiltration systems will constructed which will reduce the rate and volume of storm water runoff leaving the site while promoting groundwater recharge. The drainage patterns in the proposed condition will mimic those of the existing condition.

Soils information was obtained from available USDA Soil Conservation Service (SCS) Maps for Middlesex County. The soils on site are classified as Hinckley Loamy Sand (253B). Refer to Figure 5, SCS Soils Map, for a delineation of the boundaries of the soil with respect to the subject parcel and the attached SCS soil description. The soil conditions were confirmed by on-site soil testing performed on November 9, 2021.

The Flood Insurance Rate Map for the City of Amesbury (Community Panel 25009C0106F) with an effective date of July 3, 2012 describes the project as Zone X. Zone X is classified as areas determined to be outside the 0.2% chance floodplain.

All existing conditions information used has been compiled from an Actual on the ground survey prepared by Boston Survey, Inc. on March 20, 2021.

Pre-Development Condition

Technical Release 20 (TR-20) Program for Project Formulation Hydrology developed by the Soil Conservation Service (SCS) was employed to develop pre and post-development peak flows. Drainage calculations were performed for the pre-development condition for the 2, 10, 25, and 100-year type III 24-hour storm events. Refer to Appendix A for computer results, soil characteristics, cover descriptions and times of concentrations calculations.

In both the pre-development and post-development stormwater analysis two watershed areas

were analyzed. Refer to Existing Watershed Plan (EWP) in Appendix A for a delineation of the watershed areas as well as the location of the design points. The design points that were analyzed include design point #1 which is the closed drainage system on Hillside Avenue, design point #2 flows off-site to the northwest to Allenclair Drive.

A summary of the peak rates of the runoff during the Pre-Development Conditions is as follows:

Pre-Development Condition Peak Discharge Summary (in CFS):

	2-Year Storm (3.38 IN)	10-Year Storm (5.35 IN)	25-Year Storm (6.58 IN)	100-Year Storm (8.47 IN)
Design Point #1 (Hillside Ave)	1.01	1.88	2.41	3.23
Design Point #2 (Allenclair Drive)	0.33	0.59	0.75	1.00

Proposed Development

The proposed project consists of the construction of the mixed used development with proposed bituminous concrete driveway and parking area, landscaped areas, incidental site grading, utility connection and stormwater infiltration system. The increase in greenspace, alone, will result in a net decrease in the rate and volume of storm water runoff generated by the site. However in an effort to increase the quality of storm water runoff, a treatment stream for the parking area consisting of deep sump hooded catch basins to a water quality inlet to a sub-surface infiltration facility has been designed. The northerly parking area will also drain into its own subsurface infiltration system to mitigate stormwater runoff generated by the proposed parking area.

Proposed subsurface infiltration system #1 is comprised of 6 rows of 10 Cultec 330 XL HD Chambers. Stormwater generated by the proposed roof will drain via roof drains into the proposed system. Stormwater generated by the driveway and parking area will drain via surface flow into one of three catch basins which discharge into a Contech CDS water quality unit and ultimately into the proposed subsurface infiltration system. The northerly parking lot will drain via surface flow into a catch basin which discharges into a Contech CDS water quality unit and ultimately to proposed subsurface infiltrations system #2. This system is composed of 4 rows of 4 Cultec 330 XL HD Chambers. The systems have been sized based on the contributing areas while also incorporating an infiltration rate of 2.41 in/hr corresponding to the Rawls Rate established for a loamy sand type soil. The infiltration facilities will serve to reduce storm water runoff as well as promoting ground water recharge. The pervious paver walkway surrounding the northerly parking lot is comprise of approximately 718 square feet. The paver area is equipped with a choker course for water quality treatment followed by a 14-inch reservoir course that will store stormwater flows and allow for infiltration.

Again, drainage calculations were performed for the post-development condition for the 2, 10, 25, and 100-year type III 24-hour storm events. Refer to Appendix B for computer results, soil characteristics, cover descriptions, times of concentration calculations, and the Proposed Watershed Plans (PWP). A summary of the peak rates of runoff during the Post-Development Condition is as follows:

Post-Development Condition Peak Discharge Summary (in CFS):

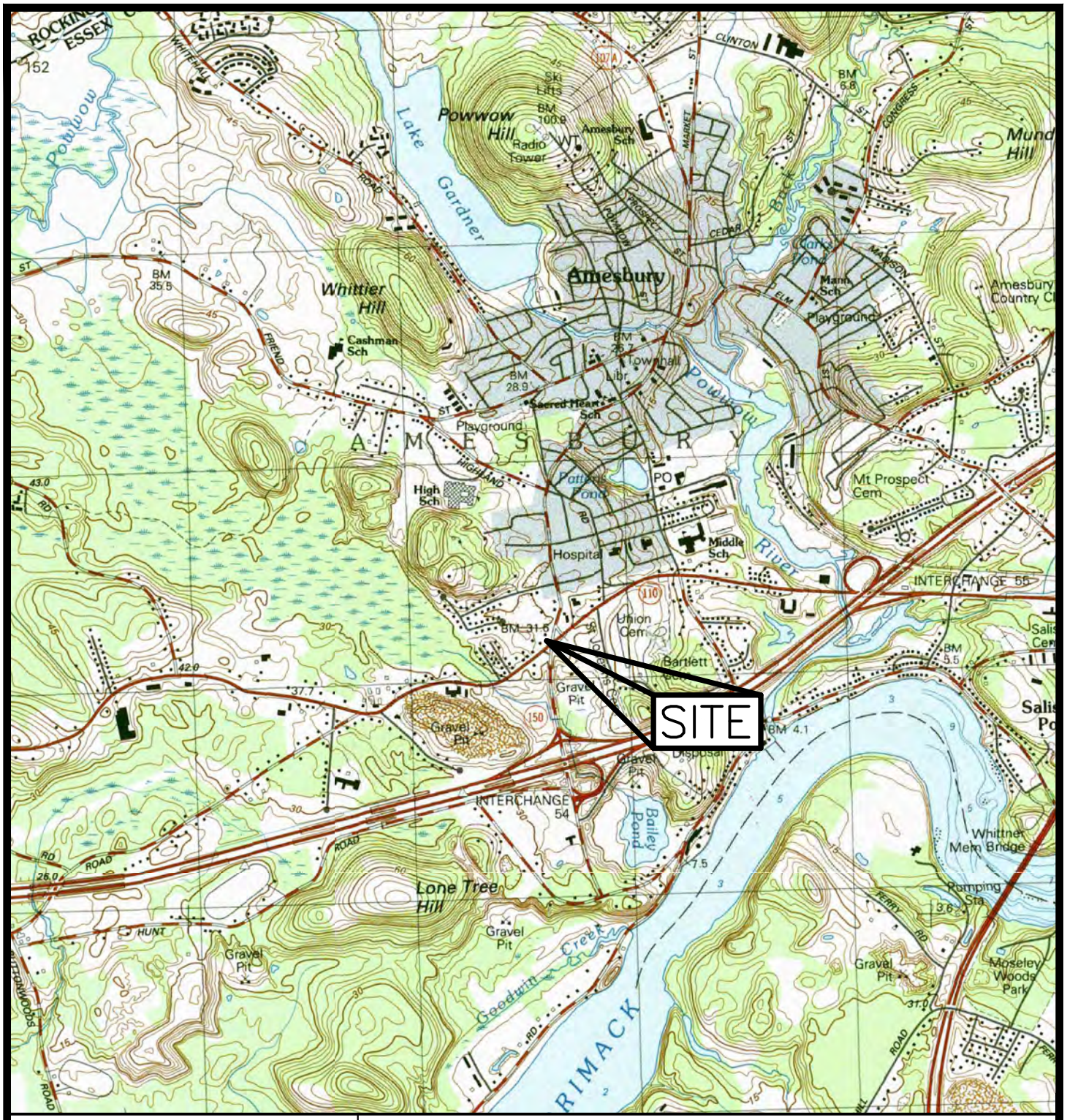
	2-Year Storm (3.38 IN)	10-Year Storm (5.35 IN)	25-Year Storm (6.58 IN)	100-Year Storm (8.47 IN)
Design Point #1 (Hillside Ave)	0.00	0.02	0.07	0.16
Design Point #2 (Allenclair Drive)	0.00	0.00	0.01	0.04

Stormwater Management Facilities

The stormwater facilities were design to attenuate peak flows generated by all storm events up to and including the 100-year storm event. An infiltration rate of 2.41 in/hr was used based on the Rawls Rate of saturated hydraulic conductivity for a loamy sand soil type. Refer to Appendix B for the Stage Storage Curves and TR-20 computer results for the storage characteristics of the subsurface infiltration facilities. Refer to the Site Plans (attached) for design details.

Erosion and Siltation Control

Straw wattles and silt fence will be placed at the downhill limit of work prior to the commencement of any construction activity. The integrity of the erosion control devices will be maintained by periodic inspection and replacement as necessary. The straw wattles and silt fence will remain in place until the first course of pavement has been placed and all side slopes have been loamed and seeded and vegetation has been established.



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PROJECT:

Plan of Land

41 Hillside Avenue
(Tax Map 76 Lot 61)
Amesbury, MA 01913

PROJECT: 21-76801	DATE: April 12, 2021
SCALE: 1:25,000	DWG FILE NAME: Figures.dwg
DESIGNED BY: Max Friedman	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:

FIGURE 1 - USGS LOCUS MAP

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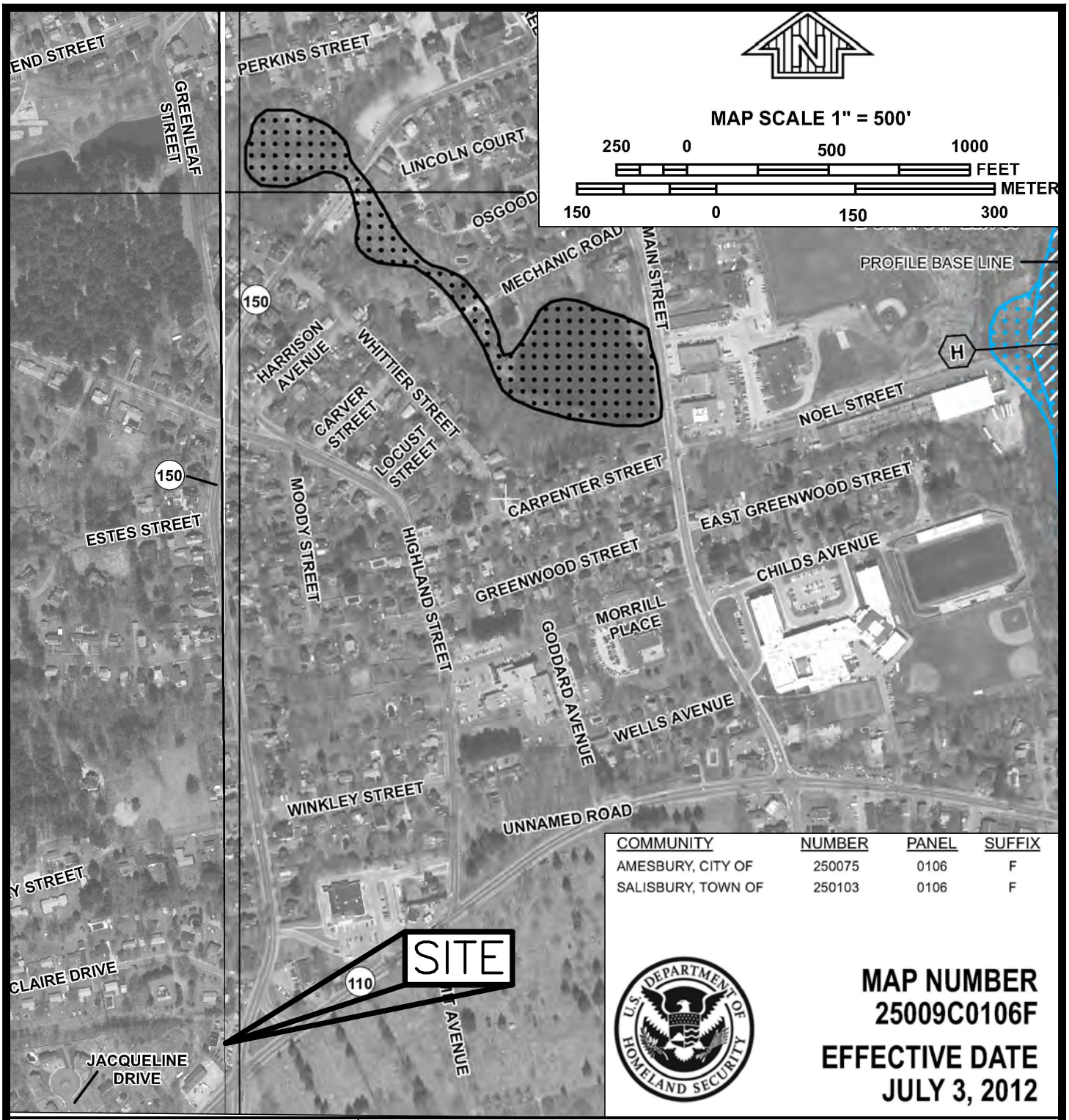
SCALE: 1"=100'	DWG FILE NAME: Figures.dwg
DESIGNED BY: Max Friedman	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:

FIGURE 2 - ORTHO PHOTO



COMMUNITY	NUMBER	PANEL	SUFFIX
AMESBURY, CITY OF	250075	0106	F
SALISBURY, TOWN OF	250103	0106	F

MAP NUMBER
25009C0106F

EFFECTIVE DATE
JULY 3, 2012

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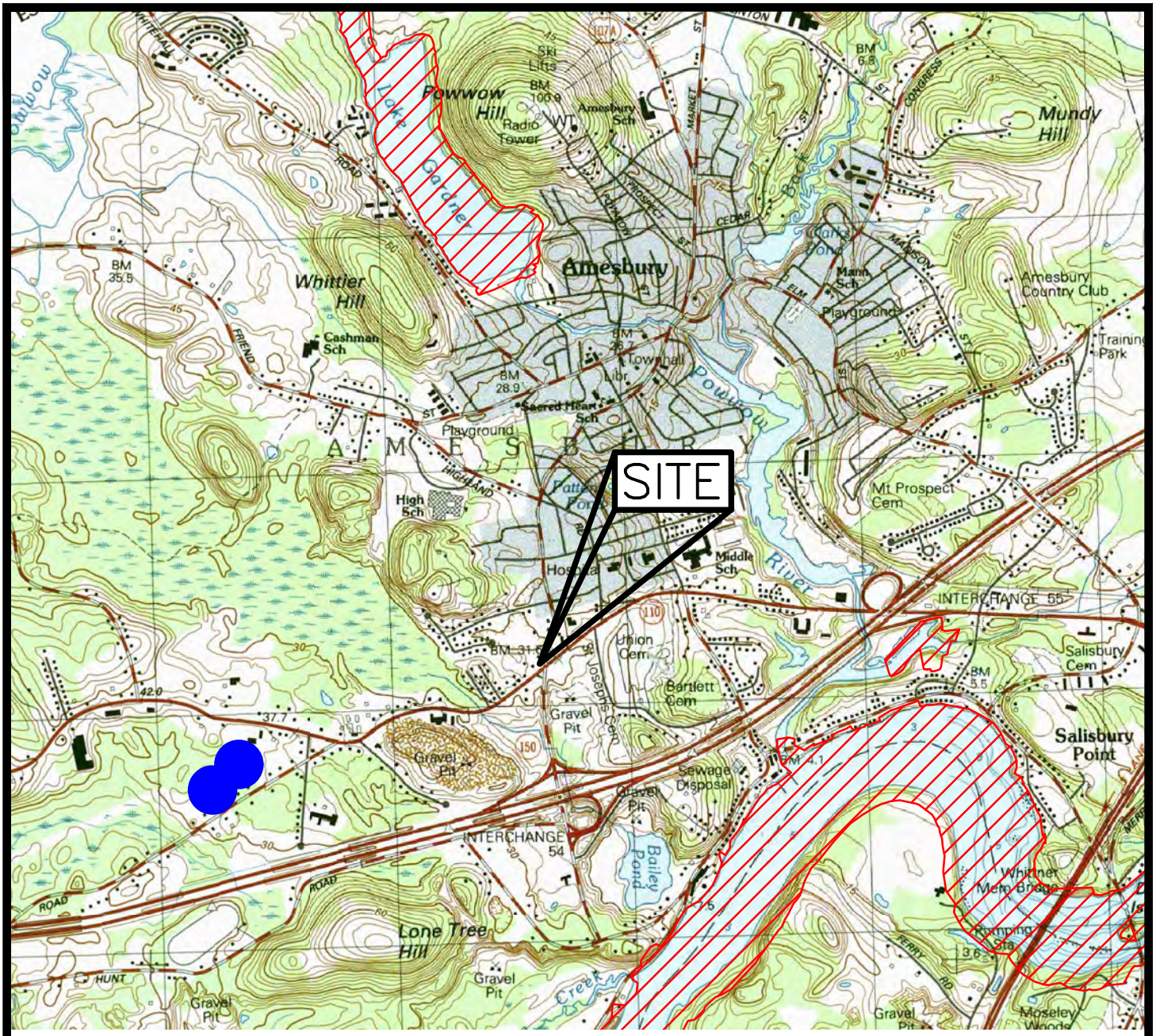
PROJECT: 21-76801	DATE: April 12, 2021
SCALE: 1"=500'	DWG FILE NAME: Figures.dwg
DESIGNED BY: Max Friedman	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:
FIGURE 3 - FEMA FLOOD MAP



LEGEND:

- = NHESP CERTIFIED VERNAL POOL
- = NHESP ESTIMATED HABITATS OF RARE SPECIES
- = NHESP PRIORITY HABITATS OF RARE SPECIES

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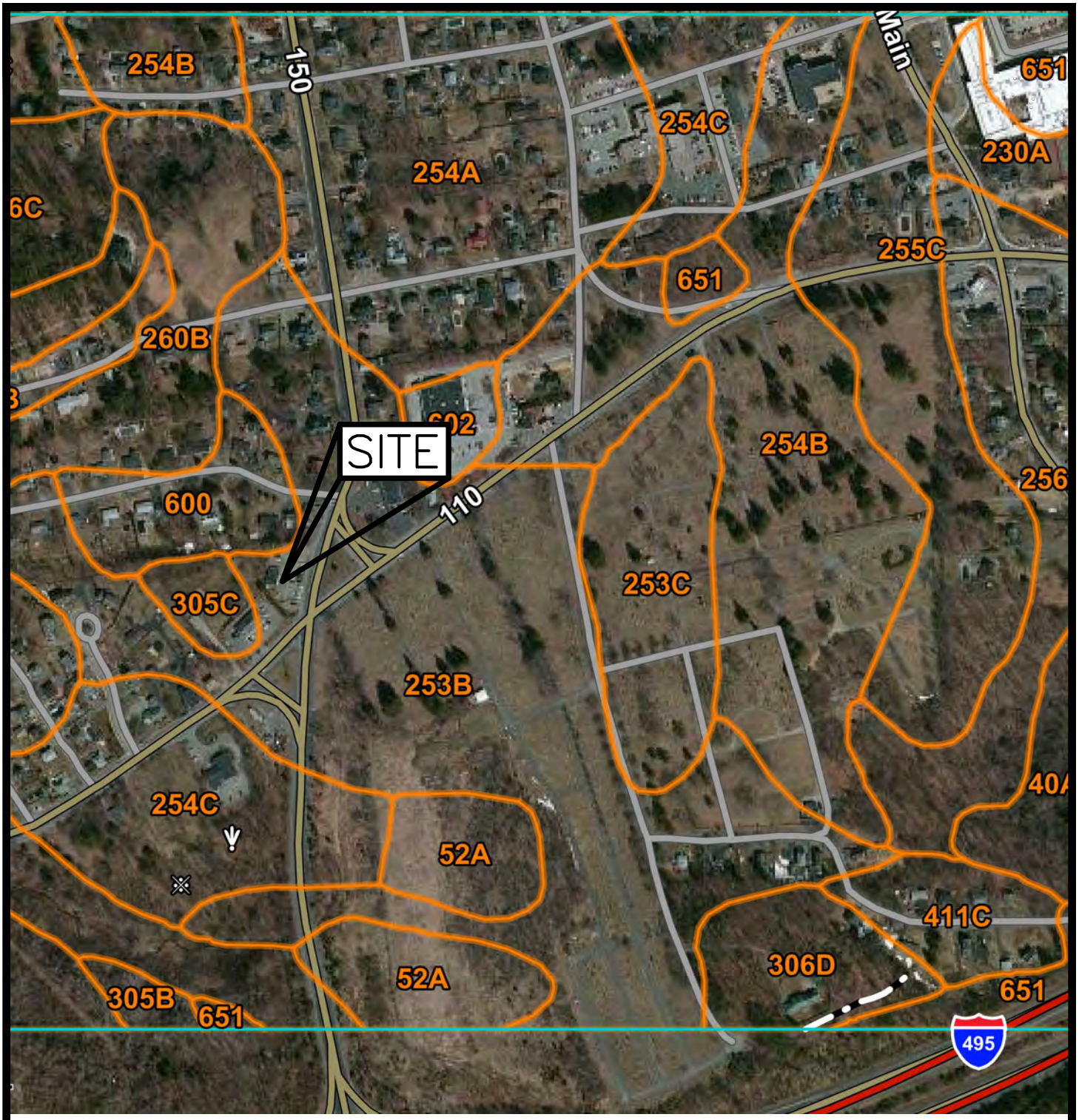
DRAWING TITLE:

FIGURE 4 - NATURAL HERITAGE MAP



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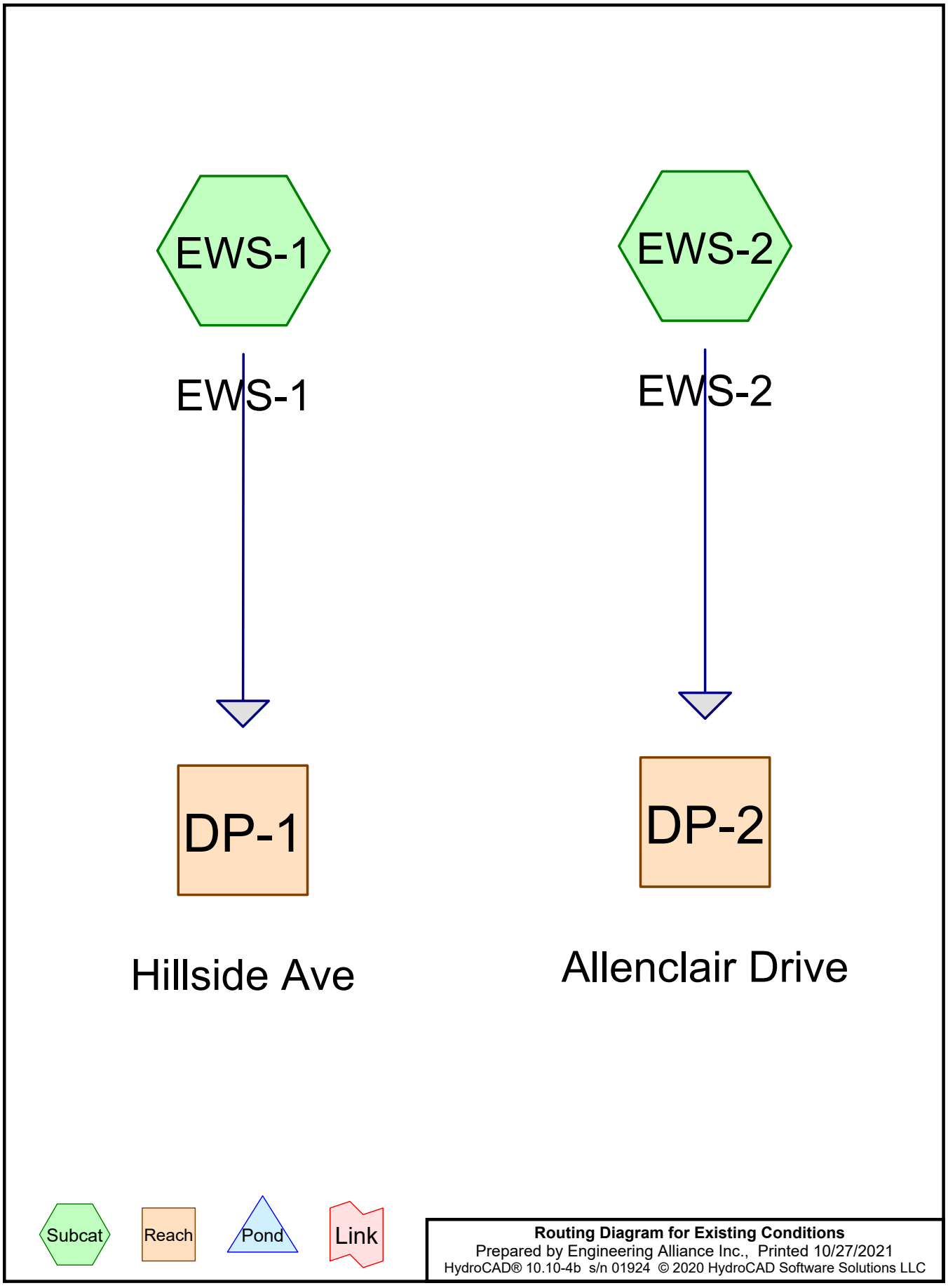
PROJECT: 21-76801	DATE: April 12, 2021
SCALE: 1"=400'	DWG FILE NAME: Figures.dwg
DESIGNED BY: Max Friedman	CHECKED BY: Richard A. Salvo, P.E.

DRAWING TITLE:

FIGURE 5 - SOILS MAP

APPENDIX A

Existing Conditions Drainage Calculations
Existing Watershed Plan



Routing Diagram for Existing Conditions
Prepared by Engineering Alliance Inc., Printed 10/27/2021

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	Type III 24-hr		Default	24.00	1	3.38	2
2	10-year	Type III 24-hr		Default	24.00	1	5.35	2
3	25-year	Type III 24-hr		Default	24.00	1	6.58	2
4	100-year	Type III 24-hr		Default	24.00	1	8.47	2

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Sub Nur
3,853	0	0	0	0	3,853	50-75% Grass cover, Fair	
0	0	4,956	0	0	4,956	Paved parking	
13,395	0	0	0	0	13,395	Roofs	
1,456	0	0	0	0	1,456	Woods/grass comb., Poor	
18,704	**0**	**4,956**	**0**	**0**	**23,660**	**TOTAL AREA**	

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: EWS-1 Runoff Area=18,177 sf 76.40% Impervious Runoff Depth>2.07"
Tc=5.0 min CN=87 Runoff=1.01 cfs 3,141 cf

Subcatchment EWS-2: EWS-2 Runoff Area=5,483 sf 81.42% Impervious Runoff Depth>2.25"
Tc=5.0 min CN=89 Runoff=0.33 cfs 1,026 cf

Reach DP-1: Hillside Ave Inflow=1.01 cfs 3,141 cf
Outflow=1.01 cfs 3,141 cf

Reach DP-2: Allenclair Drive Inflow=0.33 cfs 1,026 cf
Outflow=0.33 cfs 1,026 cf

Total Runoff Area = 23,660 sf Runoff Volume = 4,167 cf Average Runoff Depth = 2.11"
22.44% Pervious = 5,309 sf 77.56% Impervious = 18,351 sf

Summary for Subcatchment EWS-1: EWS-1

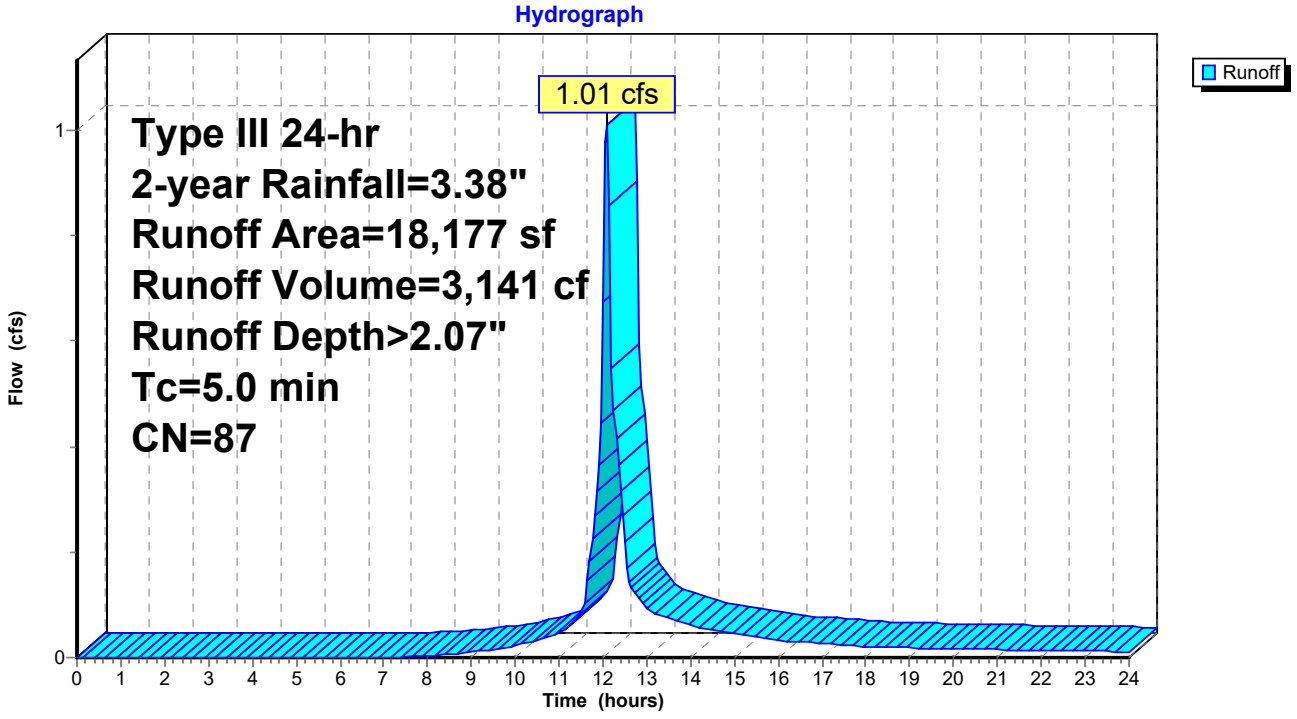
Runoff = 1.01 cfs @ 12.08 hrs, Volume= 3,141 cf, Depth> 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.38"

Area (sf)	CN	Description
1,296	98	Paved parking, HSG C
12,591	98	Roofs, HSG A
2,834	49	50-75% Grass cover, Fair, HSG A
1,456	57	Woods/grass comb., Poor, HSG A
18,177	87	Weighted Average
4,290		23.60% Pervious Area
13,887		76.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EWS-1: EWS-1



Summary for Subcatchment EWS-2: EWS-2

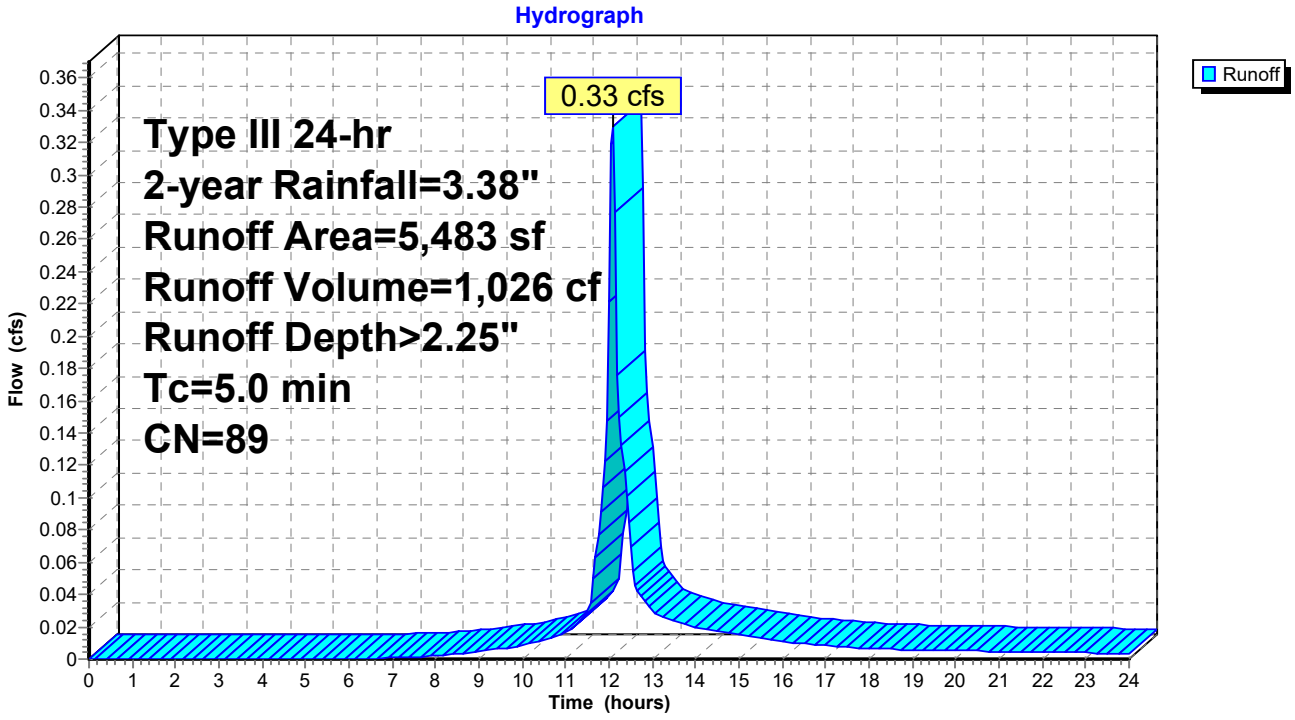
Runoff = 0.33 cfs @ 12.07 hrs, Volume= 1,026 cf, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.38"

Area (sf)	CN	Description
804	98	Roofs, HSG A
3,660	98	Paved parking, HSG C
1,019	49	50-75% Grass cover, Fair, HSG A
5,483	89	Weighted Average
1,019		18.58% Pervious Area
4,464		81.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EWS-2: EWS-2

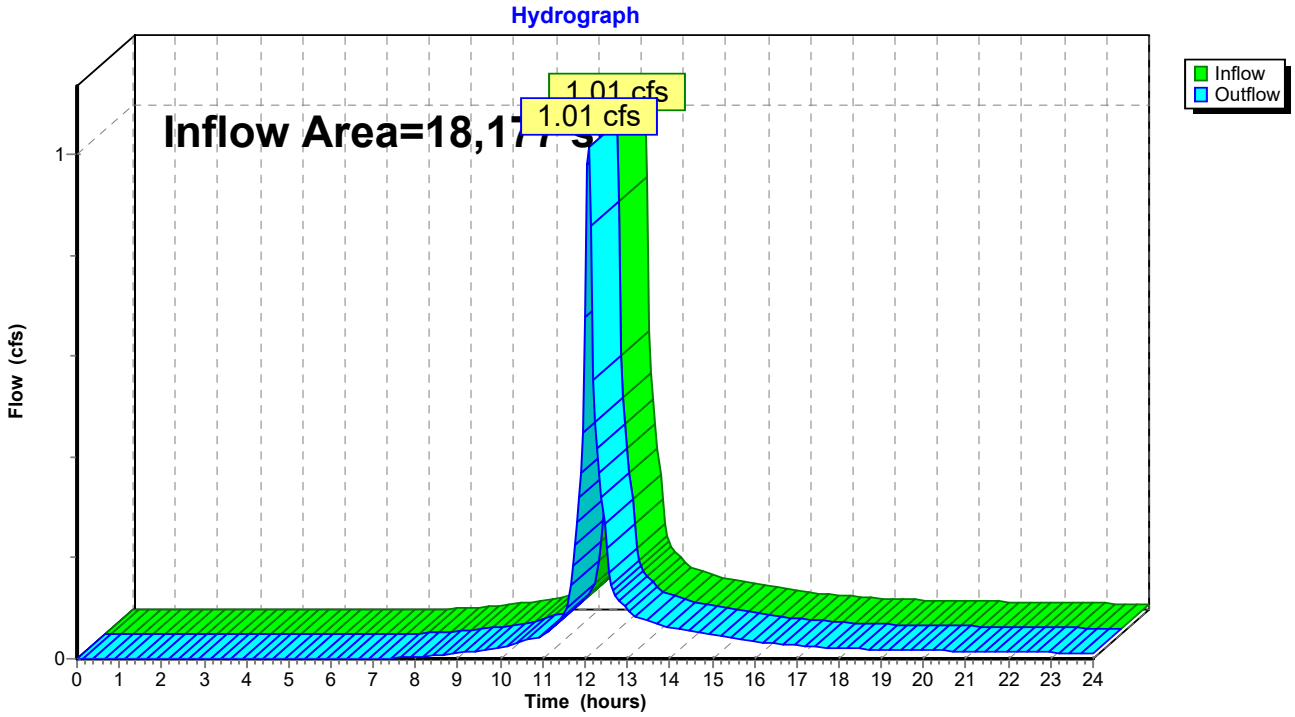


Summary for Reach DP-1: Hillside Ave

Inflow Area = 18,177 sf, 76.40% Impervious, Inflow Depth > 2.07" for 2-year event
Inflow = 1.01 cfs @ 12.08 hrs, Volume= 3,141 cf
Outflow = 1.01 cfs @ 12.08 hrs, Volume= 3,141 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Hillside Ave

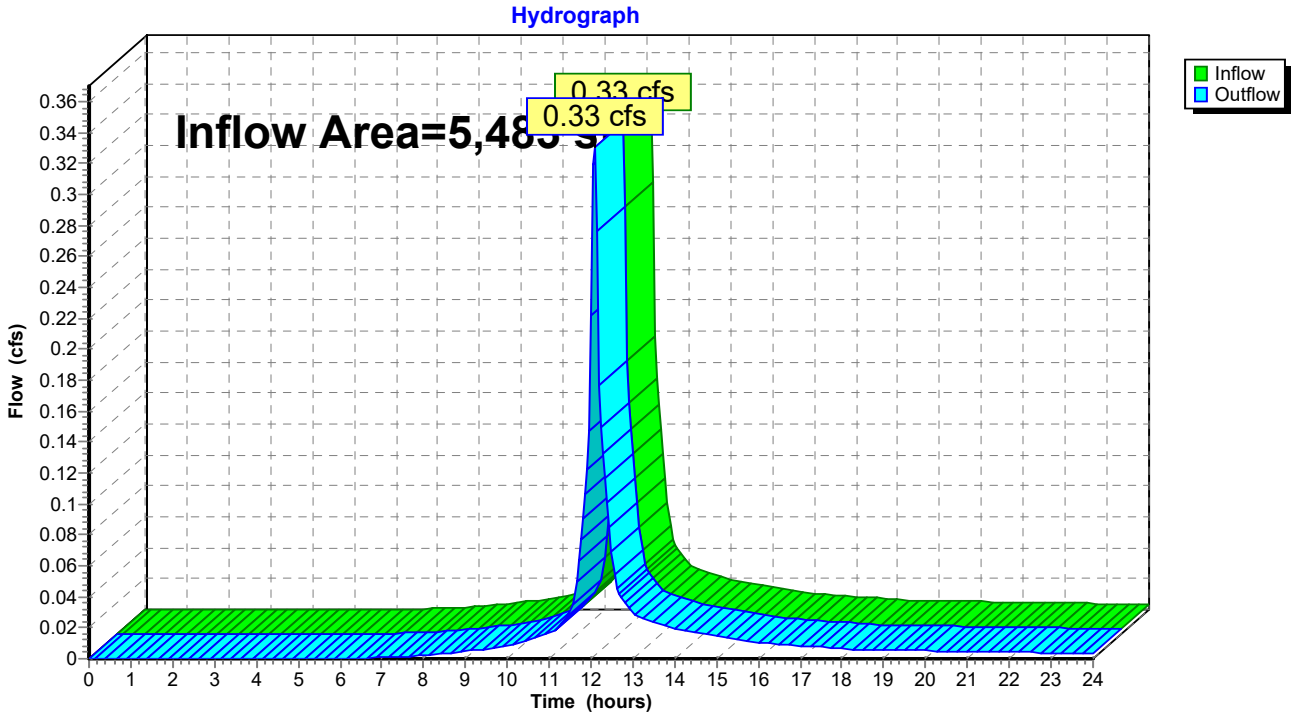


Summary for Reach DP-2: Allenclair Drive

Inflow Area = 5,483 sf, 81.42% Impervious, Inflow Depth > 2.25" for 2-year event
Inflow = 0.33 cfs @ 12.07 hrs, Volume= 1,026 cf
Outflow = 0.33 cfs @ 12.07 hrs, Volume= 1,026 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Allenclair Drive



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: EWS-1 Runoff Area=18,177 sf 76.40% Impervious Runoff Depth>3.90"
Tc=5.0 min CN=87 Runoff=1.88 cfs 5,901 cf

Subcatchment EWS-2: EWS-2 Runoff Area=5,483 sf 81.42% Impervious Runoff Depth>4.11"
Tc=5.0 min CN=89 Runoff=0.59 cfs 1,876 cf

Reach DP-1: Hillside Ave Inflow=1.88 cfs 5,901 cf
Outflow=1.88 cfs 5,901 cf

Reach DP-2: Allenclair Drive Inflow=0.59 cfs 1,876 cf
Outflow=0.59 cfs 1,876 cf

Total Runoff Area = 23,660 sf Runoff Volume = 7,777 cf Average Runoff Depth = 3.94"
22.44% Pervious = 5,309 sf 77.56% Impervious = 18,351 sf

Summary for Subcatchment EWS-1: EWS-1

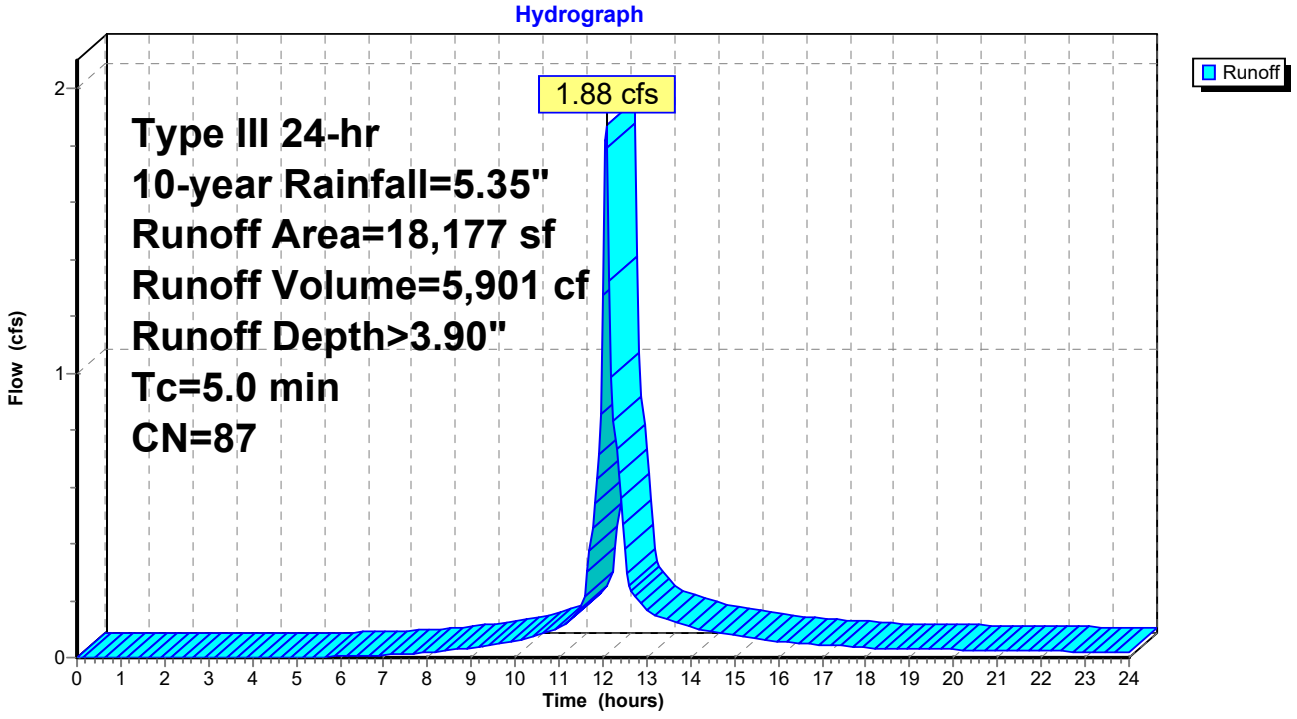
Runoff = 1.88 cfs @ 12.07 hrs, Volume= 5,901 cf, Depth> 3.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.35"

Area (sf)	CN	Description
1,296	98	Paved parking, HSG C
12,591	98	Roofs, HSG A
2,834	49	50-75% Grass cover, Fair, HSG A
1,456	57	Woods/grass comb., Poor, HSG A
18,177	87	Weighted Average
4,290		23.60% Pervious Area
13,887		76.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EWS-1: EWS-1



Summary for Subcatchment EWS-2: EWS-2

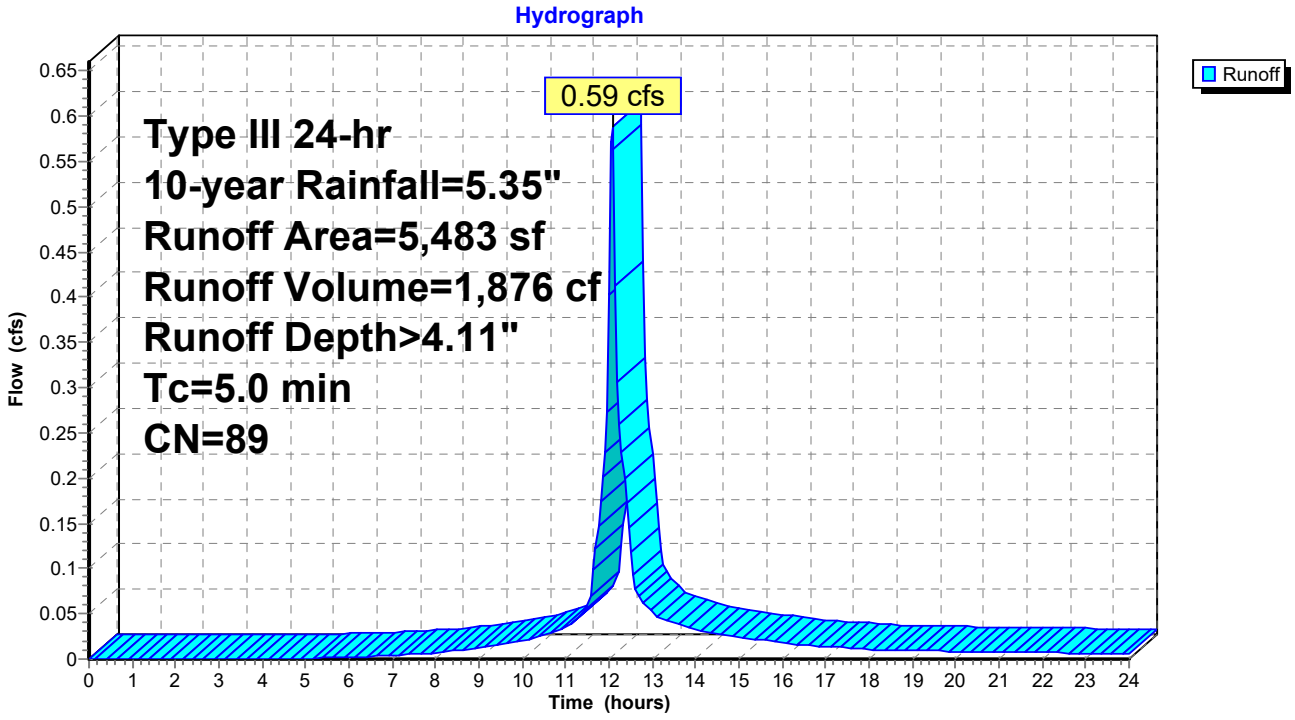
Runoff = 0.59 cfs @ 12.07 hrs, Volume= 1,876 cf, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.35"

Area (sf)	CN	Description
804	98	Roofs, HSG A
3,660	98	Paved parking, HSG C
1,019	49	50-75% Grass cover, Fair, HSG A
5,483	89	Weighted Average
1,019		18.58% Pervious Area
4,464		81.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EWS-2: EWS-2

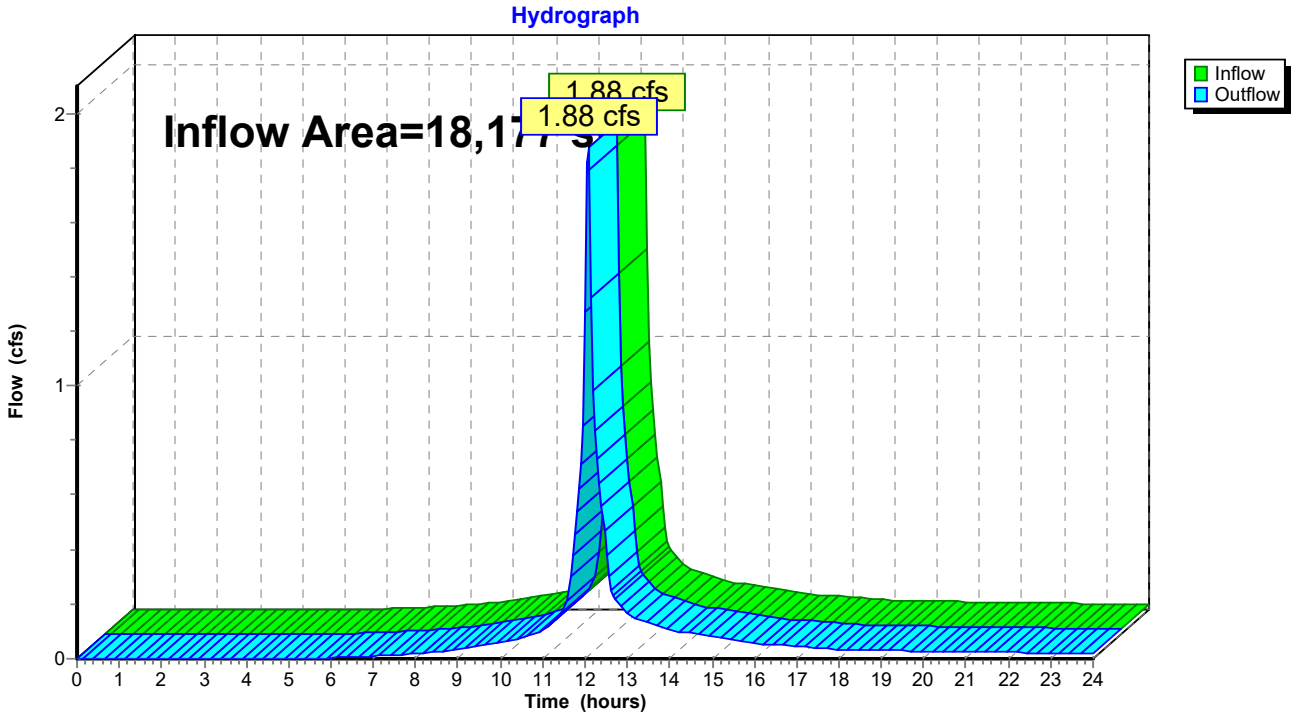


Summary for Reach DP-1: Hillside Ave

Inflow Area = 18,177 sf, 76.40% Impervious, Inflow Depth > 3.90" for 10-year event
Inflow = 1.88 cfs @ 12.07 hrs, Volume= 5,901 cf
Outflow = 1.88 cfs @ 12.07 hrs, Volume= 5,901 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Hillside Ave

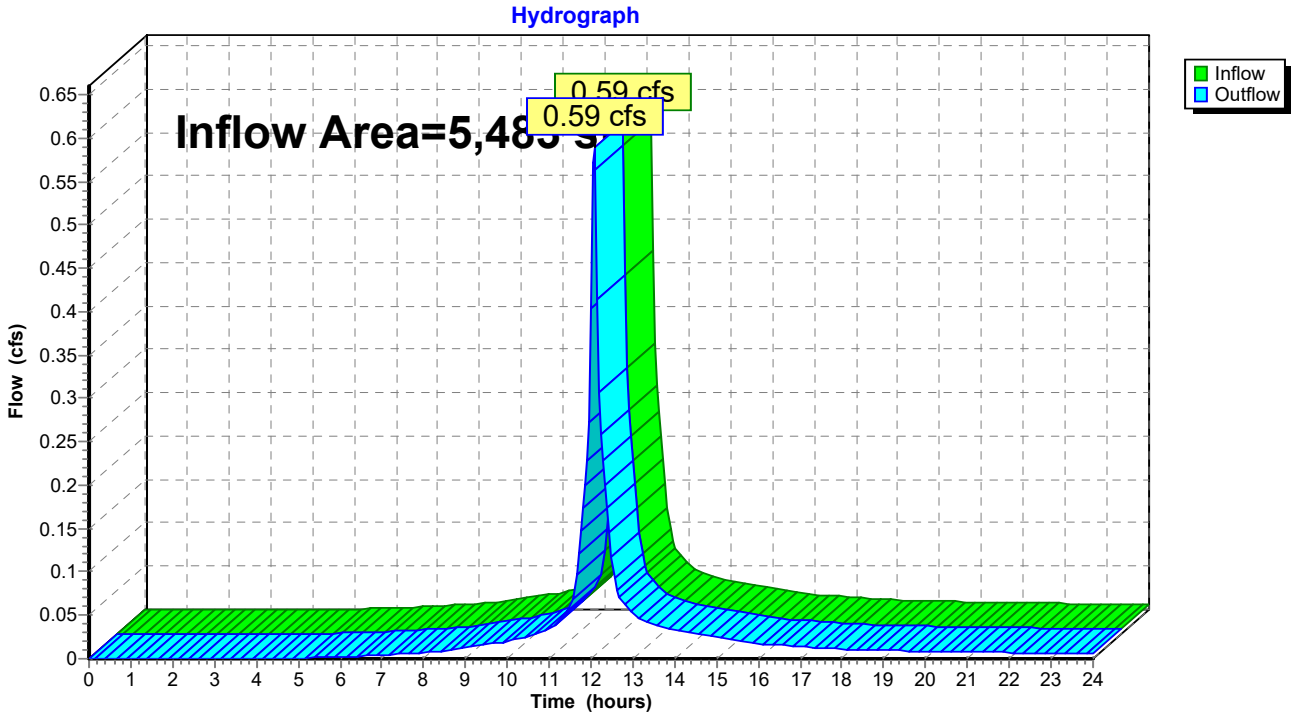


Summary for Reach DP-2: Allenclair Drive

Inflow Area = 5,483 sf, 81.42% Impervious, Inflow Depth > 4.11" for 10-year event
Inflow = 0.59 cfs @ 12.07 hrs, Volume= 1,876 cf
Outflow = 0.59 cfs @ 12.07 hrs, Volume= 1,876 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Allenclair Drive



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: EWS-1 Runoff Area=18,177 sf 76.40% Impervious Runoff Depth>5.07"
Tc=5.0 min CN=87 Runoff=2.41 cfs 7,682 cf

Subcatchment EWS-2: EWS-2 Runoff Area=5,483 sf 81.42% Impervious Runoff Depth>5.30"
Tc=5.0 min CN=89 Runoff=0.75 cfs 2,420 cf

Reach DP-1: Hillside Ave Inflow=2.41 cfs 7,682 cf
Outflow=2.41 cfs 7,682 cf

Reach DP-2: Allenclair Drive Inflow=0.75 cfs 2,420 cf
Outflow=0.75 cfs 2,420 cf

Total Runoff Area = 23,660 sf Runoff Volume = 10,101 cf Average Runoff Depth = 5.12"
22.44% Pervious = 5,309 sf 77.56% Impervious = 18,351 sf

Summary for Subcatchment EWS-1: EWS-1

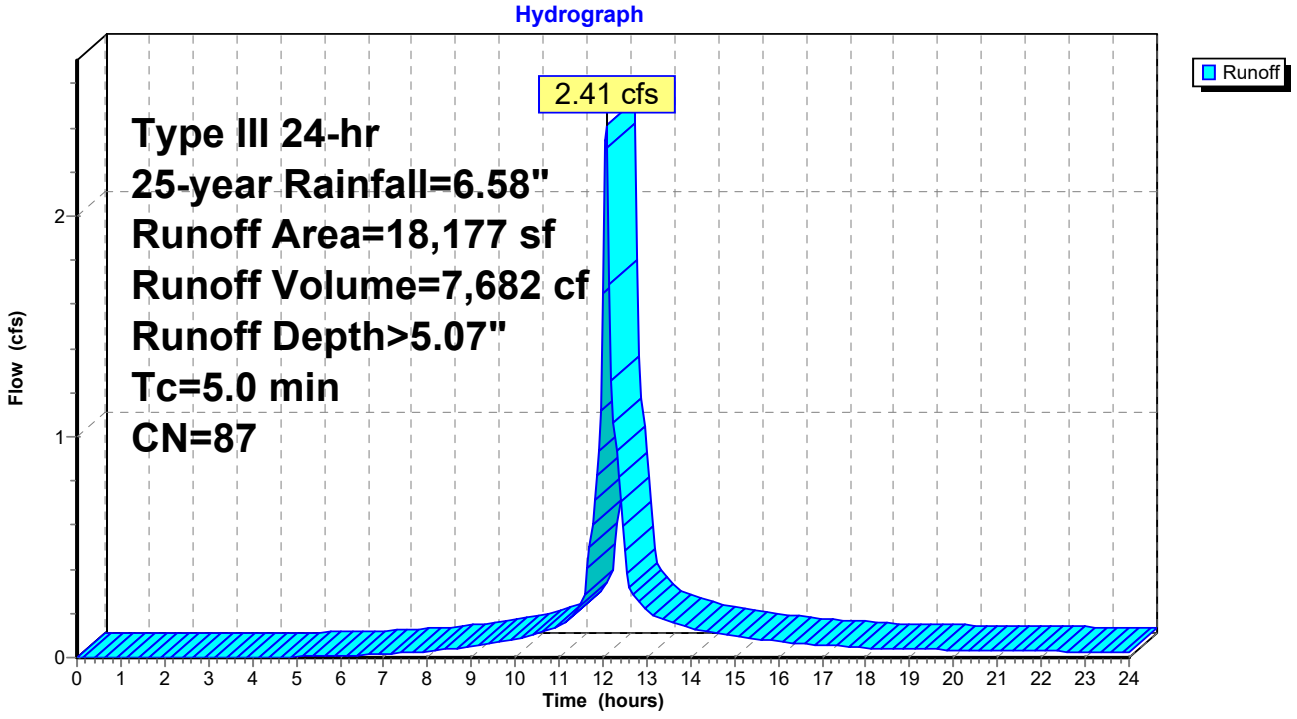
Runoff = 2.41 cfs @ 12.07 hrs, Volume= 7,682 cf, Depth> 5.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.58"

Area (sf)	CN	Description
1,296	98	Paved parking, HSG C
12,591	98	Roofs, HSG A
2,834	49	50-75% Grass cover, Fair, HSG A
1,456	57	Woods/grass comb., Poor, HSG A
18,177	87	Weighted Average
4,290		23.60% Pervious Area
13,887		76.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EWS-1: EWS-1



Summary for Subcatchment EWS-2: EWS-2

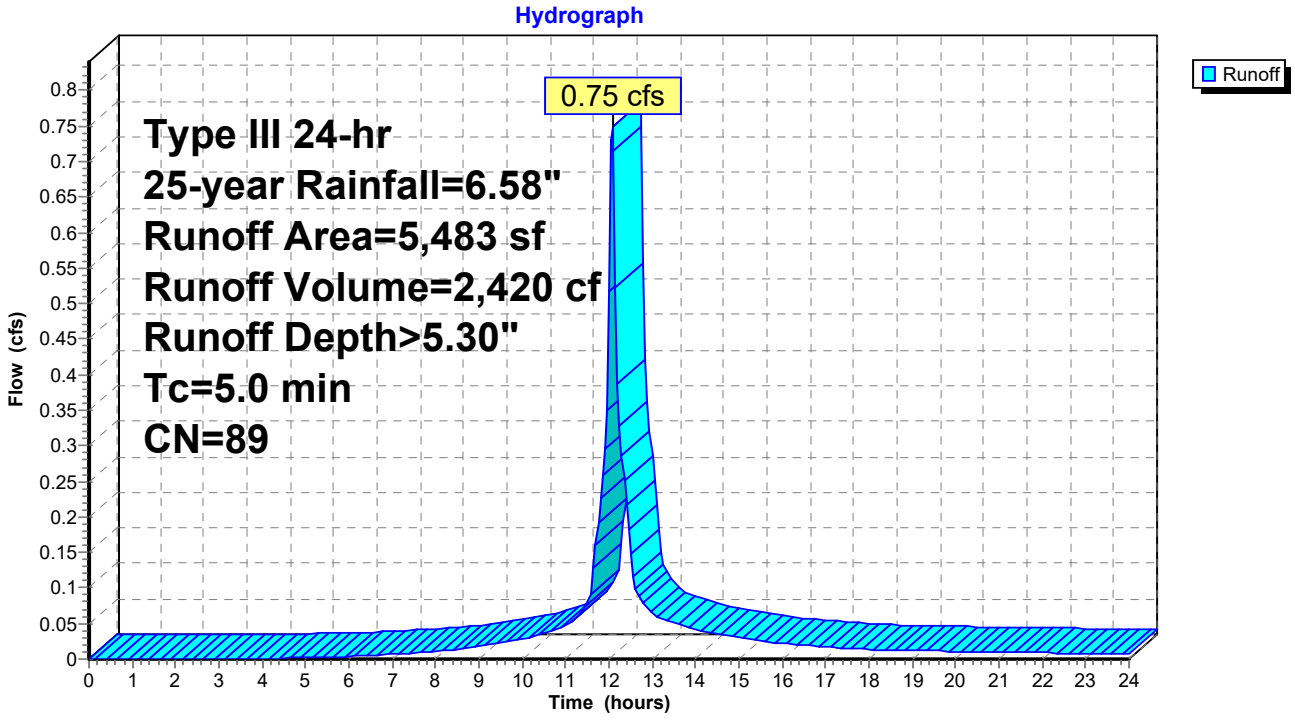
Runoff = 0.75 cfs @ 12.07 hrs, Volume= 2,420 cf, Depth> 5.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.58"

Area (sf)	CN	Description
804	98	Roofs, HSG A
3,660	98	Paved parking, HSG C
1,019	49	50-75% Grass cover, Fair, HSG A
5,483	89	Weighted Average
1,019		18.58% Pervious Area
4,464		81.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EWS-2: EWS-2

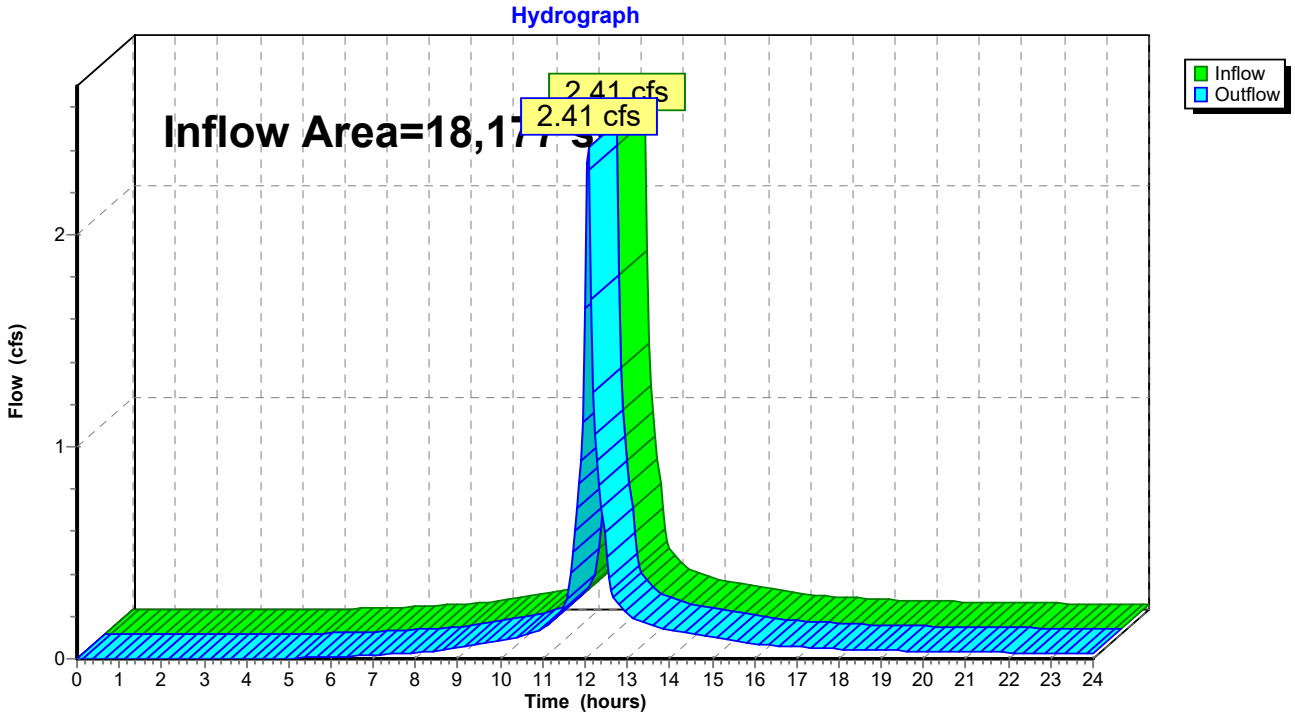


Summary for Reach DP-1: Hillside Ave

Inflow Area = 18,177 sf, 76.40% Impervious, Inflow Depth > 5.07" for 25-year event
Inflow = 2.41 cfs @ 12.07 hrs, Volume= 7,682 cf
Outflow = 2.41 cfs @ 12.07 hrs, Volume= 7,682 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Hillside Ave

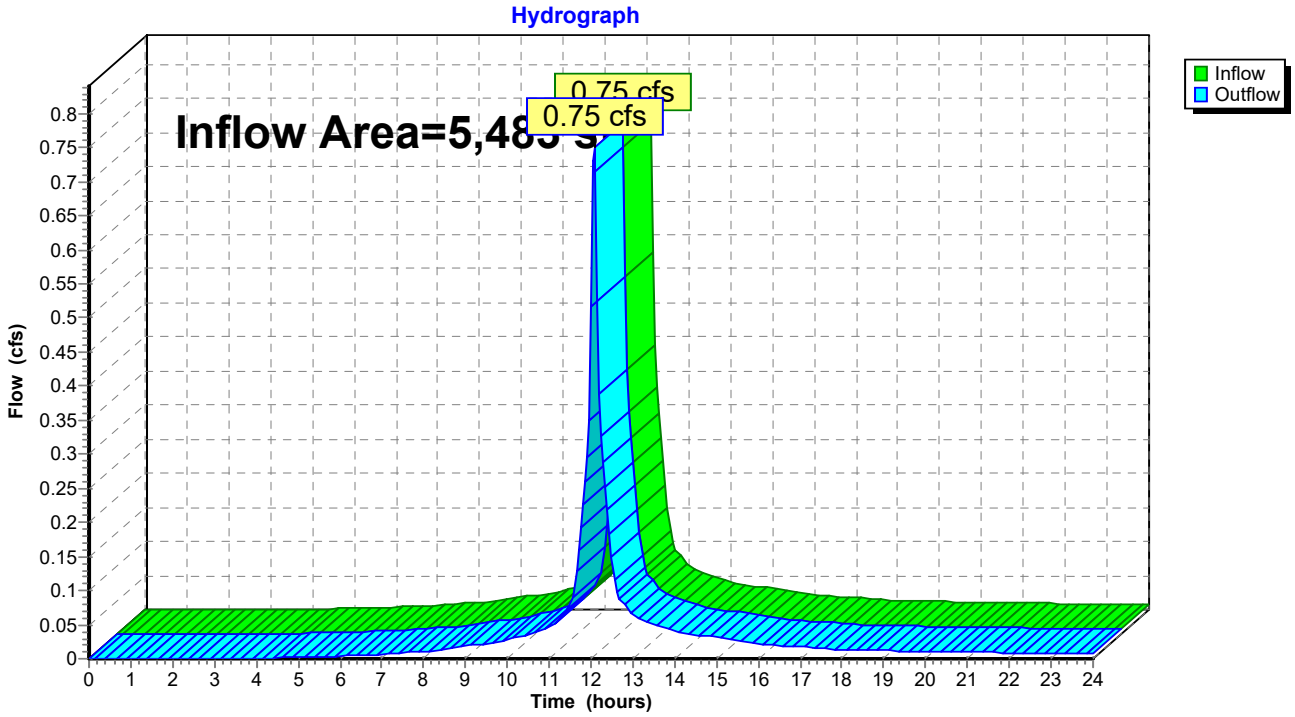


Summary for Reach DP-2: Allenclair Drive

Inflow Area = 5,483 sf, 81.42% Impervious, Inflow Depth > 5.30" for 25-year event
Inflow = 0.75 cfs @ 12.07 hrs, Volume= 2,420 cf
Outflow = 0.75 cfs @ 12.07 hrs, Volume= 2,420 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Allenclair Drive



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment EWS-1: EWS-1 Runoff Area=18,177 sf 76.40% Impervious Runoff Depth>6.90"
Tc=5.0 min CN=87 Runoff=3.23 cfs 10,458 cf

Subcatchment EWS-2: EWS-2 Runoff Area=5,483 sf 81.42% Impervious Runoff Depth>7.14"
Tc=5.0 min CN=89 Runoff=1.00 cfs 3,264 cf

Reach DP-1: Hillside Ave Inflow=3.23 cfs 10,458 cf
Outflow=3.23 cfs 10,458 cf

Reach DP-2: Allenclair Drive Inflow=1.00 cfs 3,264 cf
Outflow=1.00 cfs 3,264 cf

Total Runoff Area = 23,660 sf Runoff Volume = 13,723 cf Average Runoff Depth = 6.96"
22.44% Pervious = 5,309 sf 77.56% Impervious = 18,351 sf

Summary for Subcatchment EWS-1: EWS-1

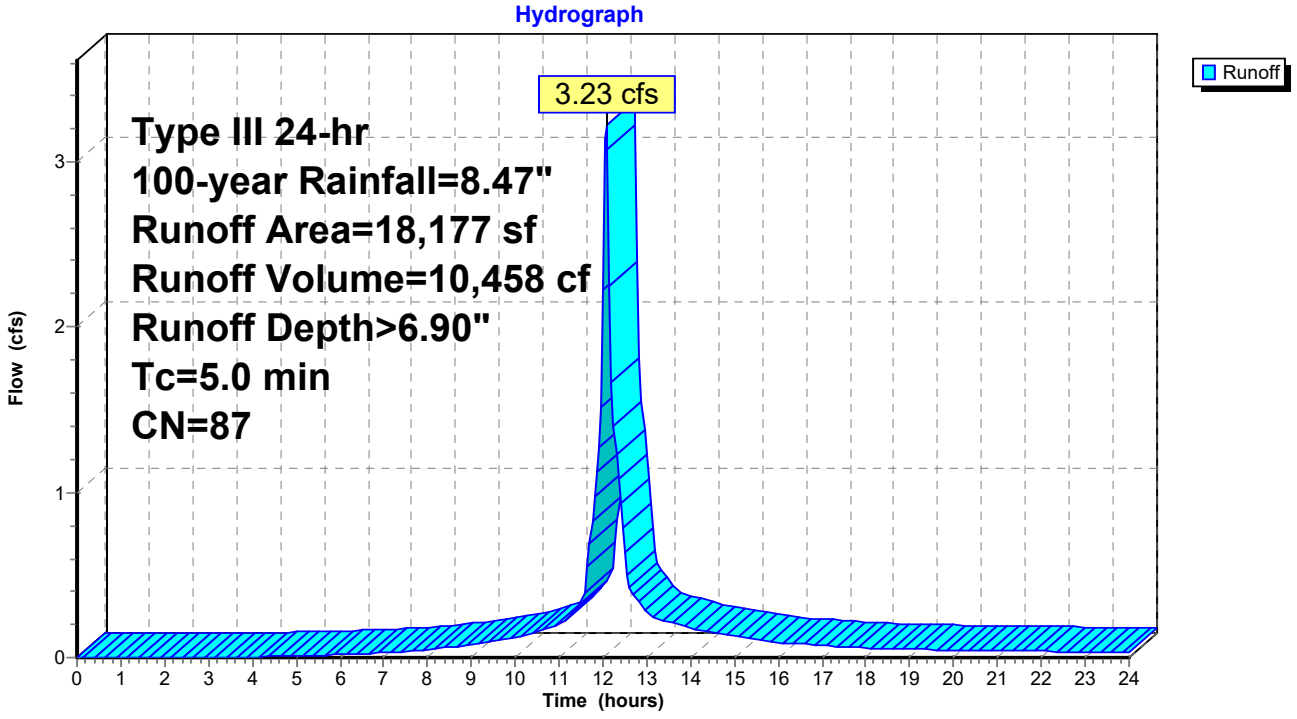
Runoff = 3.23 cfs @ 12.07 hrs, Volume= 10,458 cf, Depth> 6.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.47"

Area (sf)	CN	Description
1,296	98	Paved parking, HSG C
12,591	98	Roofs, HSG A
2,834	49	50-75% Grass cover, Fair, HSG A
1,456	57	Woods/grass comb., Poor, HSG A
18,177	87	Weighted Average
4,290		23.60% Pervious Area
13,887		76.40% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EWS-1: EWS-1



Summary for Subcatchment EWS-2: EWS-2

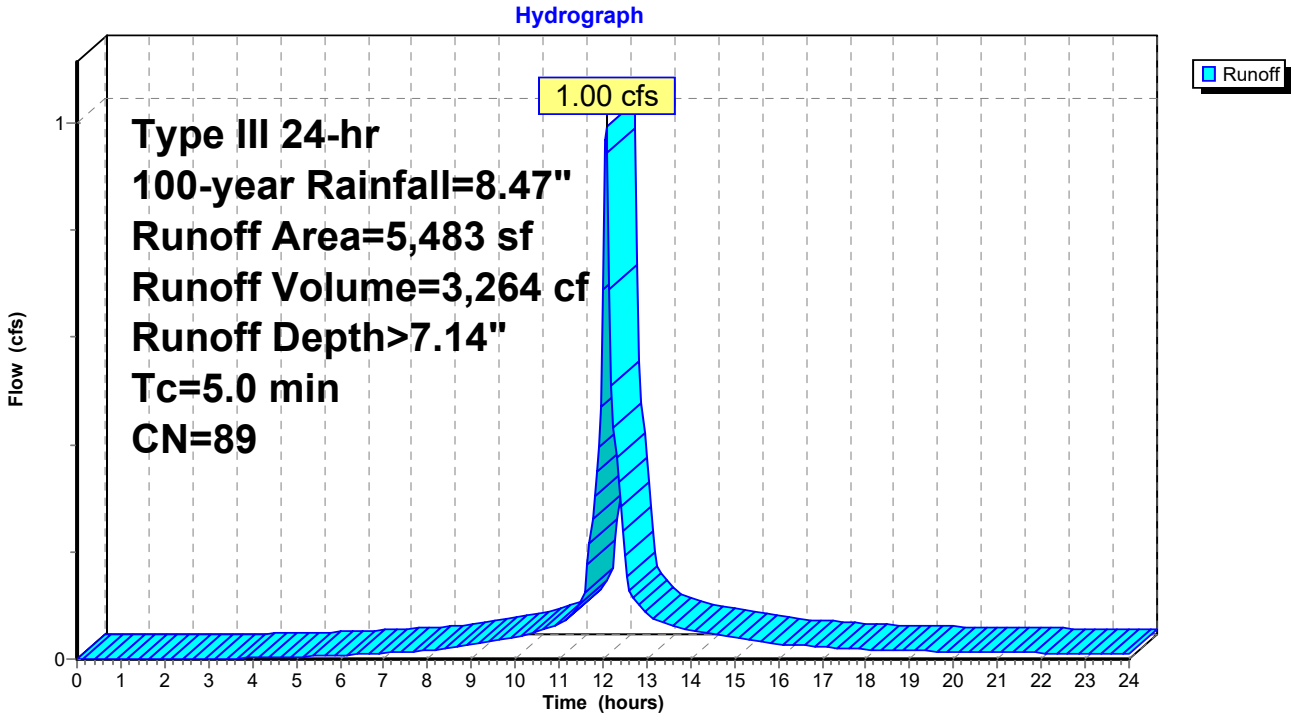
Runoff = 1.00 cfs @ 12.07 hrs, Volume= 3,264 cf, Depth> 7.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.47"

Area (sf)	CN	Description
804	98	Roofs, HSG A
3,660	98	Paved parking, HSG C
1,019	49	50-75% Grass cover, Fair, HSG A
5,483	89	Weighted Average
1,019		18.58% Pervious Area
4,464		81.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment EWS-2: EWS-2

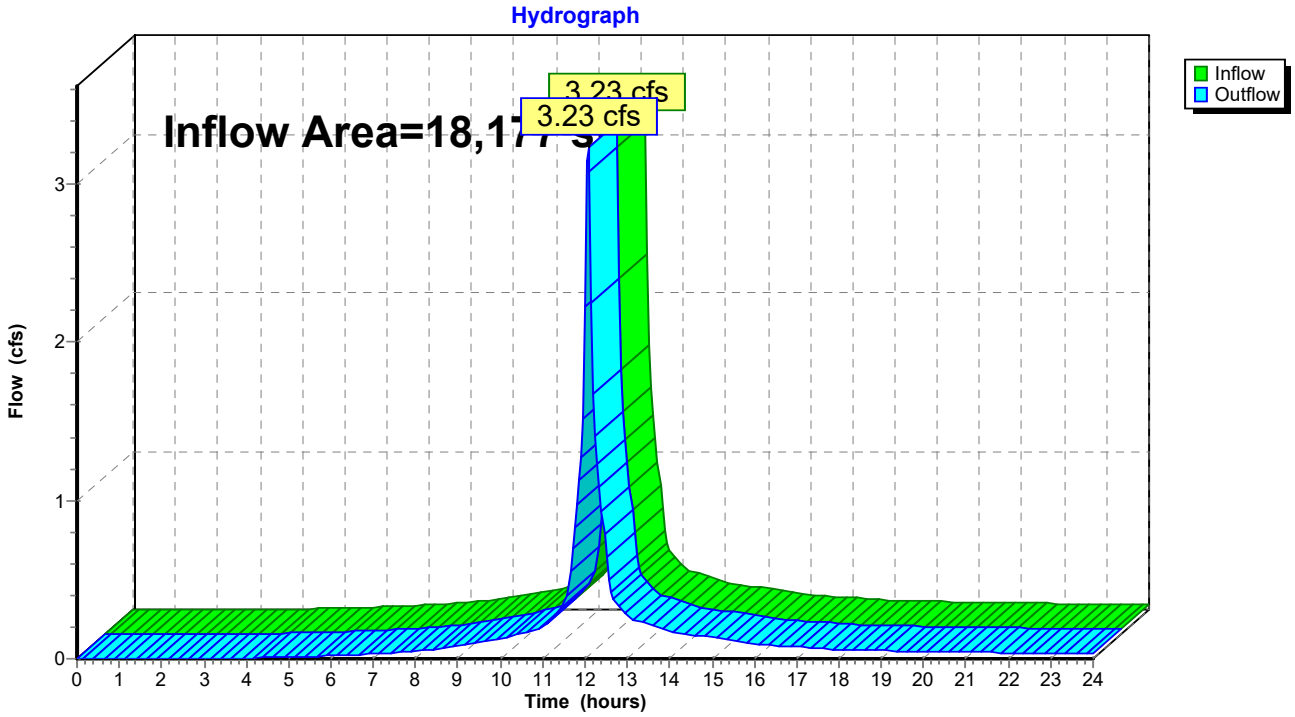


Summary for Reach DP-1: Hillside Ave

Inflow Area = 18,177 sf, 76.40% Impervious, Inflow Depth > 6.90" for 100-year event
Inflow = 3.23 cfs @ 12.07 hrs, Volume= 10,458 cf
Outflow = 3.23 cfs @ 12.07 hrs, Volume= 10,458 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Hillside Ave

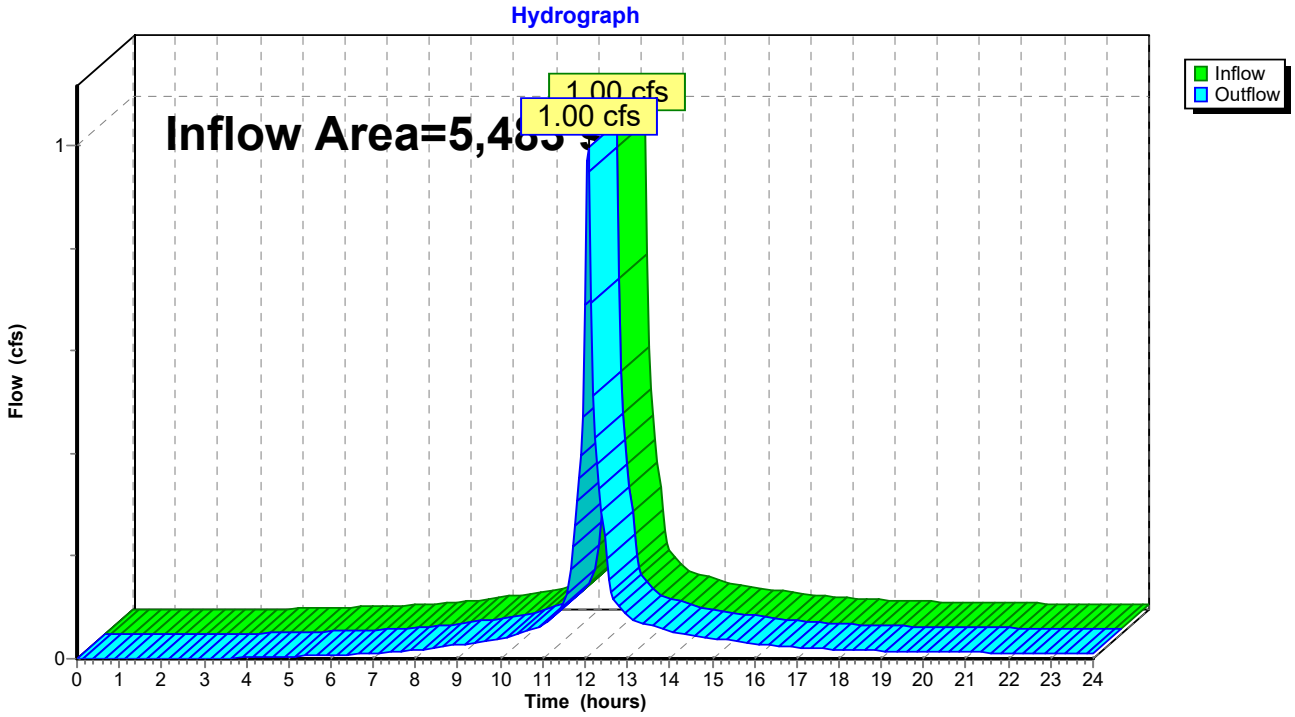


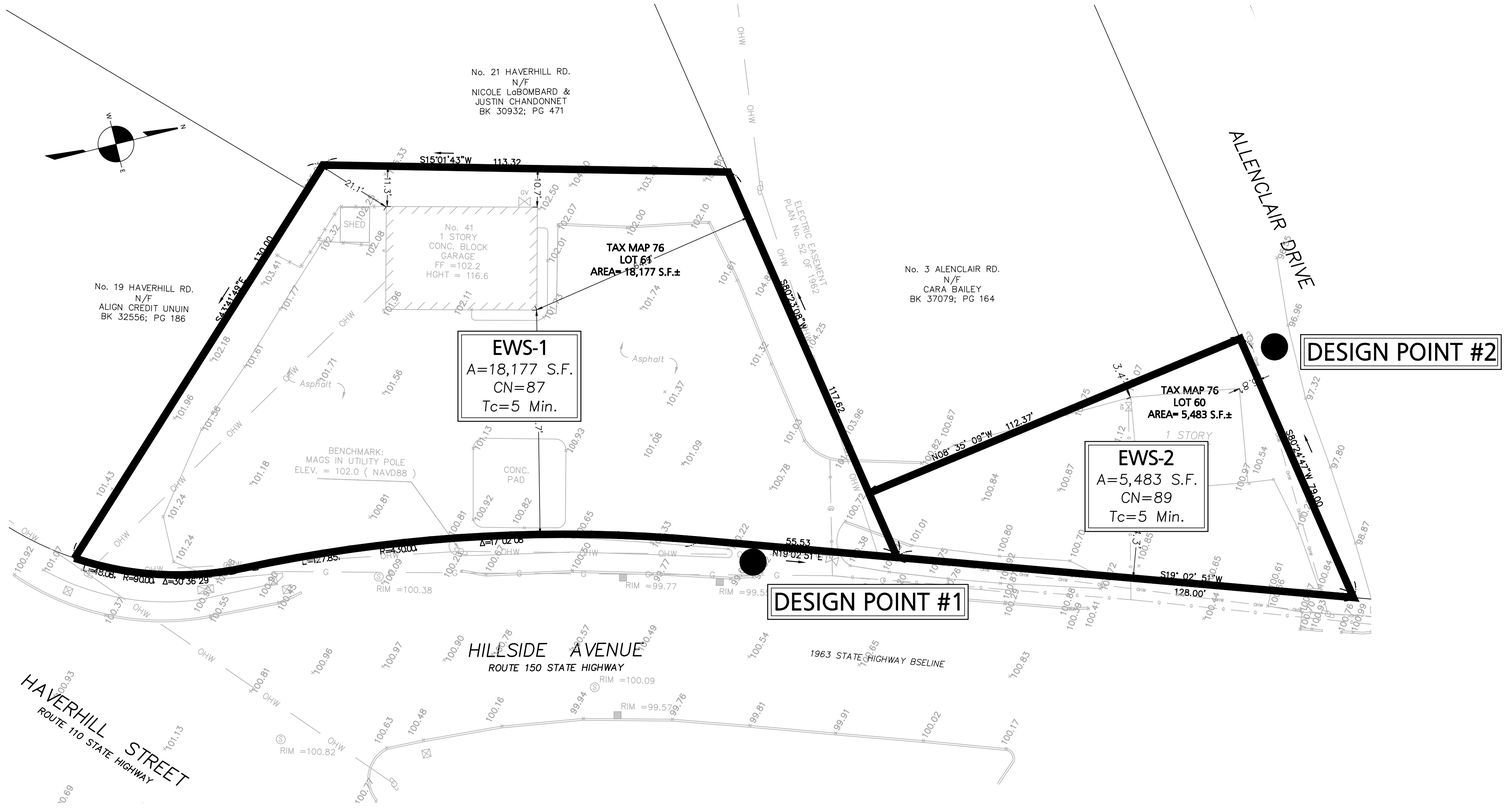
Summary for Reach DP-2: Allenclair Drive

Inflow Area = 5,483 sf, 81.42% Impervious, Inflow Depth > 7.14" for 100-year event
Inflow = 1.00 cfs @ 12.07 hrs, Volume= 3,264 cf
Outflow = 1.00 cfs @ 12.07 hrs, Volume= 3,264 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Allenclair Drive





GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

LEGEND - EXISTING CONDITIONS PLAN

PROPERTY LINE	
EXISTING BUILDING	
EXISTING EDGE OF PAVEMENT	
EXISTING CURB	
EXISTING CHAIN LINK FENCE	
EXISTING WATER LINE	W W W
EXISTING WATER VALVE	WV
EXISTING HYDRANT	
EXISTING SEWER LINE	S S S
EXISTING SEWER MANHOLE	S
EXISTING GAS LINE	G G G
EXISTING GAS VALVE	GV
EXISTING UTILITY POLE	
EXISTING SPOT SHOT	×99.99

GENERAL NOTES

OWNER OF RECORD: ANGIOLILLO MANAGEMENT GROUP INC,
99 WALNUT STREET
SAUGUS, MA 01906

DEED REFERENCE: BOOK 37464, PAGE 344
DEED REFERENCE: BOOK 36487, PAGE 19

TAX MAP REFERENCE: MAP 76 LOTS 60 & 61

EXISTING CONDITIONS INFORMATION OBTAINED FROM AN ACTUAL ON THE GROUND SURVEY PREPARED BY BOSTON SURVEY, INC. ON MARCH 20, 2021

DATUM REFERENCE: NAVD 88
ACCORDING TO THE F.E.M.A. MAP FOR ESSEX COUNTY, MAP No. 25009C0106F, DATED JULY 3, 2012, THE SUBJECT PROPERTY IS LOCATED IN A ZONE X.

COMMONWEALTH OF MASSACHUSETTS
RICHARD A SALVO
CIVIL
No. 41851
REGISTERED PROFESSIONAL ENGINEER

DESCRIPTION OF REVISION	DATE

PREPARED BY:
Engineering Alliance, Inc.
Civil Engineering & Land Planning Consultants
1950 Lafayette Road
194 Central Street
Portsmouth, NH 03801
Saugus, MA 01906
Tel: (603) 610-7100
Tel: (781) 231-1349
Fax: (603) 610-7101
Fax: (781) 417-0020

PREPARED BY:
BOSTON SURVEY, INC.
UNIT C-4 SHIPWAYS PLACE
EAST BOSTON, MA. 02129
(617) 242-1313
www.bostonsurveyinc.com

PROJECT:
Site Development Plan
39 & 41 Hillside Avenue
Amesbury, Massachusetts

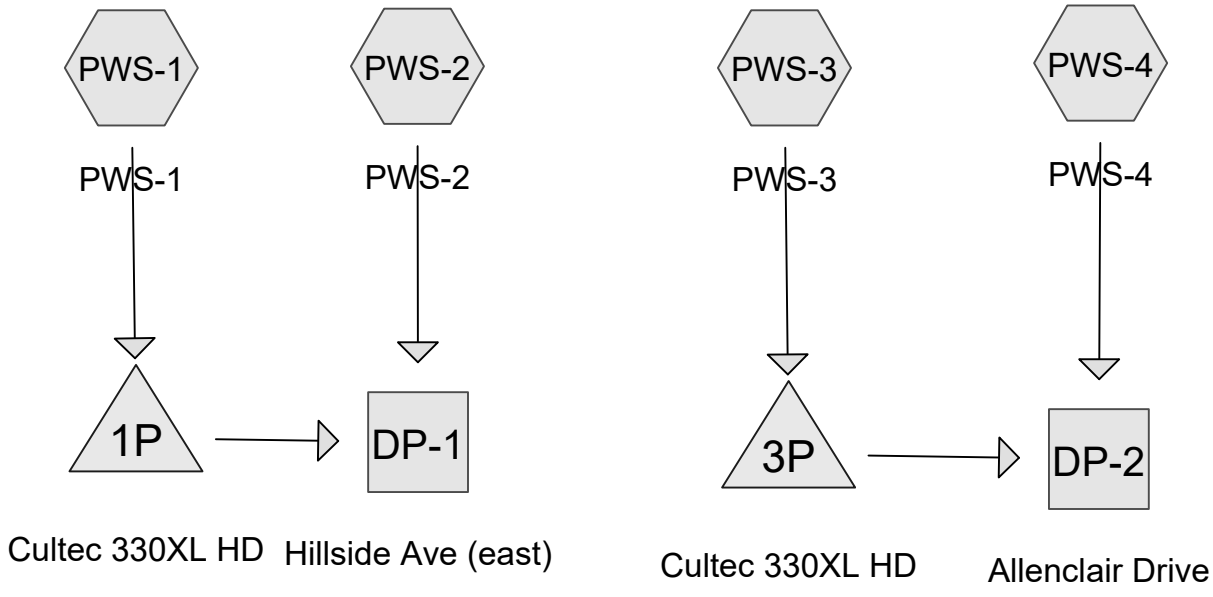
PROJECT #: 21-76801 | DATE: October 26, 2021
SCALE: AS NOTED | DWG FILE NAME: 21-76801.dwg
DESIGN BY: Max Friedman | CHECKED BY: Richard A. Salvo P.E.

OWNER :
Angiolillo Management
Group Inc.
99 Walnut Street
Saugus, MA 01906

DWG. NO.: EWS
DRAWING TITLE: Existing Watershed Plan

APPENDIX B

Proposed Conditions Drainage Calculations
Proposed Watershed Plan



Subcat Reach Pond Link

Routing Diagram for Proposed Conditions 11-11-21
Prepared by Engineering Alliance, Inc., Printed 11/18/2021

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1: PWS-1 Runoff Area=14,968 sf 88.88% Impervious Runoff Depth>2.43"
Tc=5.0 min CN=91 Runoff=0.96 cfs 3,026 cf

Subcatchment PWS-2: PWS-2 Runoff Area=3,444 sf 10.80% Impervious Runoff Depth>0.07"
Tc=5.0 min CN=45 Runoff=0.00 cfs 19 cf

Subcatchment PWS-3: PWS-3 Runoff Area=3,881 sf 85.24% Impervious Runoff Depth>2.25"
Tc=5.0 min CN=89 Runoff=0.23 cfs 726 cf

Subcatchment PWS-4: PWS-4 Runoff Area=1,367 sf 0.00% Impervious Runoff Depth>0.00"
Tc=5.0 min CN=39 Runoff=0.00 cfs 0 cf

Reach DP-1: Hillside Ave (east) Inflow=0.00 cfs 19 cf
Outflow=0.00 cfs 19 cf

Reach DP-2: Allenclair Drive Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond 1P: Cultec 330XL HD Peak Elev=95.70' Storage=1,003 cf Inflow=0.96 cfs 3,026 cf
Discarded=0.13 cfs 3,022 cf Primary=0.00 cfs 0 cf Outflow=0.13 cfs 3,022 cf

Pond 3P: Cultec 330XL HD Peak Elev=95.88' Storage=222 cf Inflow=0.23 cfs 726 cf
Discarded=0.04 cfs 725 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 725 cf

Total Runoff Area = 23,660 sf Runoff Volume = 3,772 cf Average Runoff Depth = 1.91"
28.22% Pervious = 6,676 sf 71.78% Impervious = 16,984 sf

Summary for Subcatchment PWS-1: PWS-1

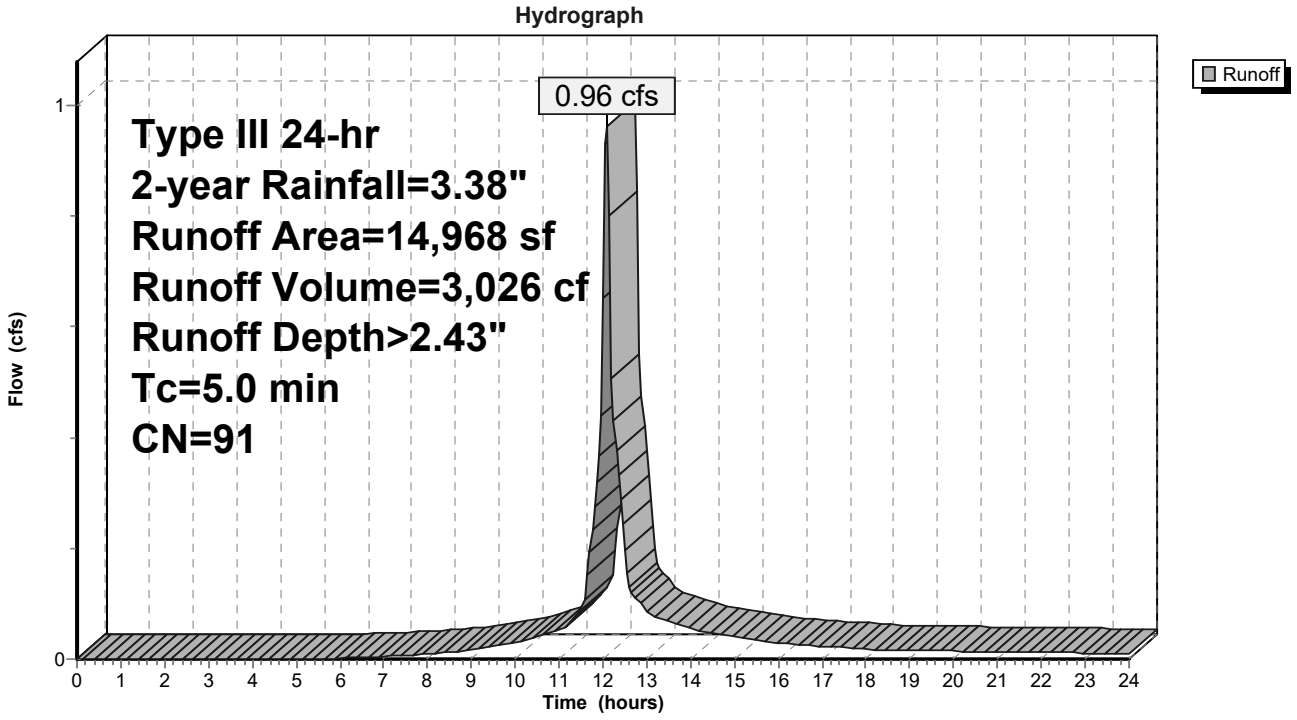
Runoff = 0.96 cfs @ 12.07 hrs, Volume= 3,026 cf, Depth> 2.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.38"

Area (sf)	CN	Description
8,635	98	Paved parking, HSG A
4,669	98	Roofs, HSG A
1,664	39	>75% Grass cover, Good, HSG A
14,968	91	Weighted Average
1,664		11.12% Pervious Area
13,304		88.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-1: PWS-1



Summary for Subcatchment PWS-2: PWS-2

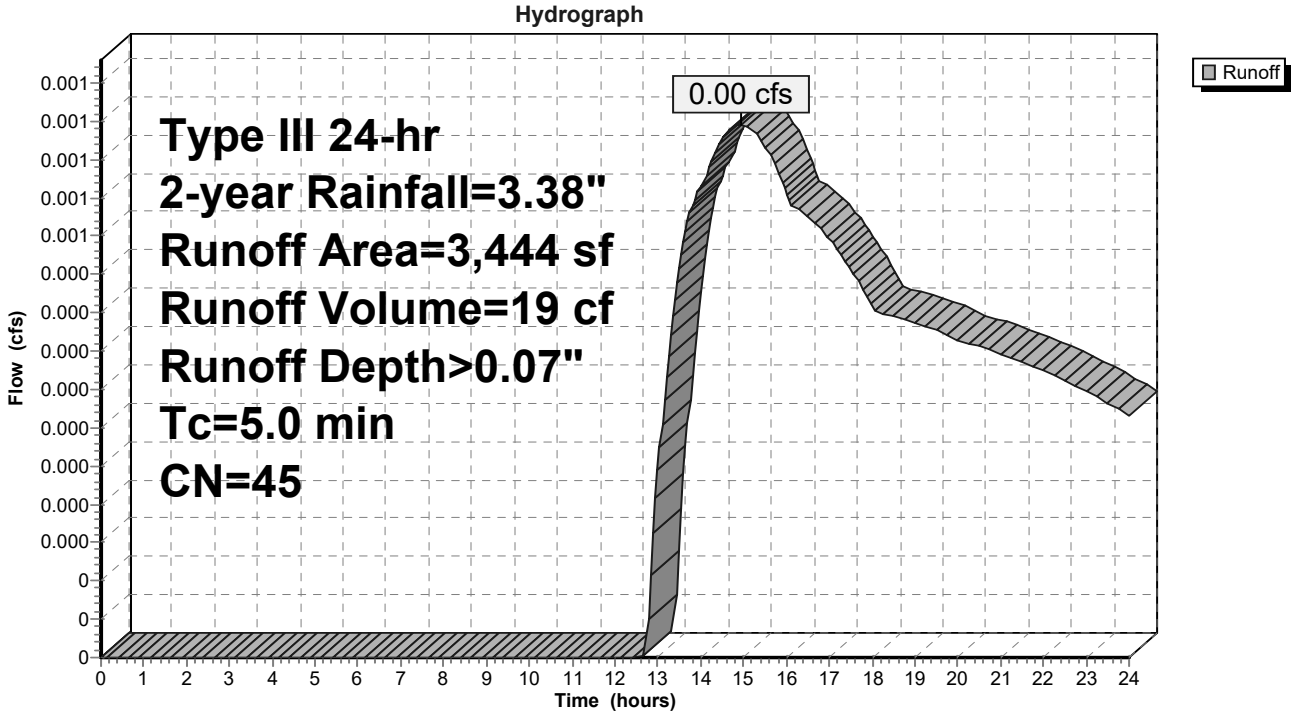
Runoff = 0.00 cfs @ 14.94 hrs, Volume= 19 cf, Depth> 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.38"

Area (sf)	CN	Description
3,072	39	>75% Grass cover, Good, HSG A
372	98	Paved roads w/curbs & sewers, HSG A
3,444	45	Weighted Average
3,072		89.20% Pervious Area
372		10.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-2: PWS-2



Summary for Subcatchment PWS-3: PWS-3

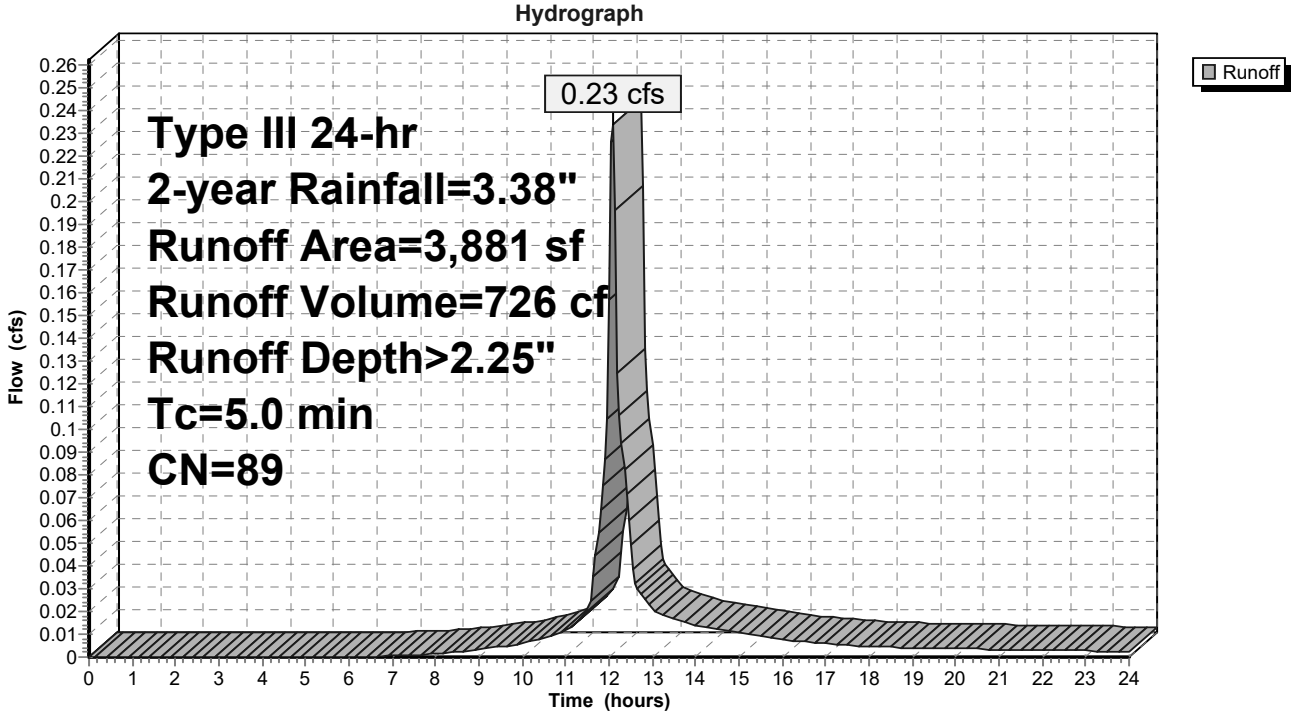
Runoff = 0.23 cfs @ 12.07 hrs, Volume= 726 cf, Depth> 2.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.38"

	Area (sf)	CN	Description
	573	39	>75% Grass cover, Good, HSG A
	3,290	98	Paved parking, HSG A
*	18	98	Walk, HSG A
	3,881	89	Weighted Average
	573		14.76% Pervious Area
	3,308		85.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-3: PWS-3



Summary for Subcatchment PWS-4: PWS-4

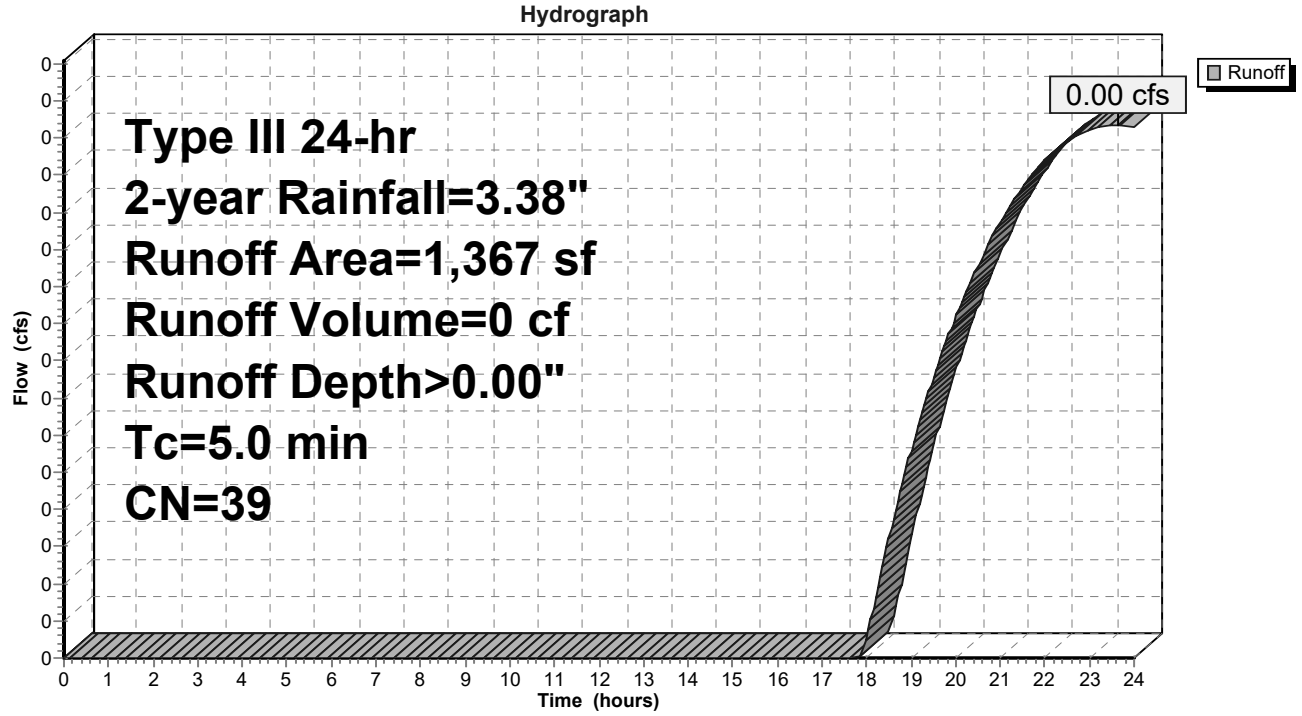
Runoff = 0.00 cfs @ 23.64 hrs, Volume= 0 cf, Depth> 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.38"

Area (sf)	CN	Description
1,367	39	>75% Grass cover, Good, HSG A
1,367		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-4: PWS-4

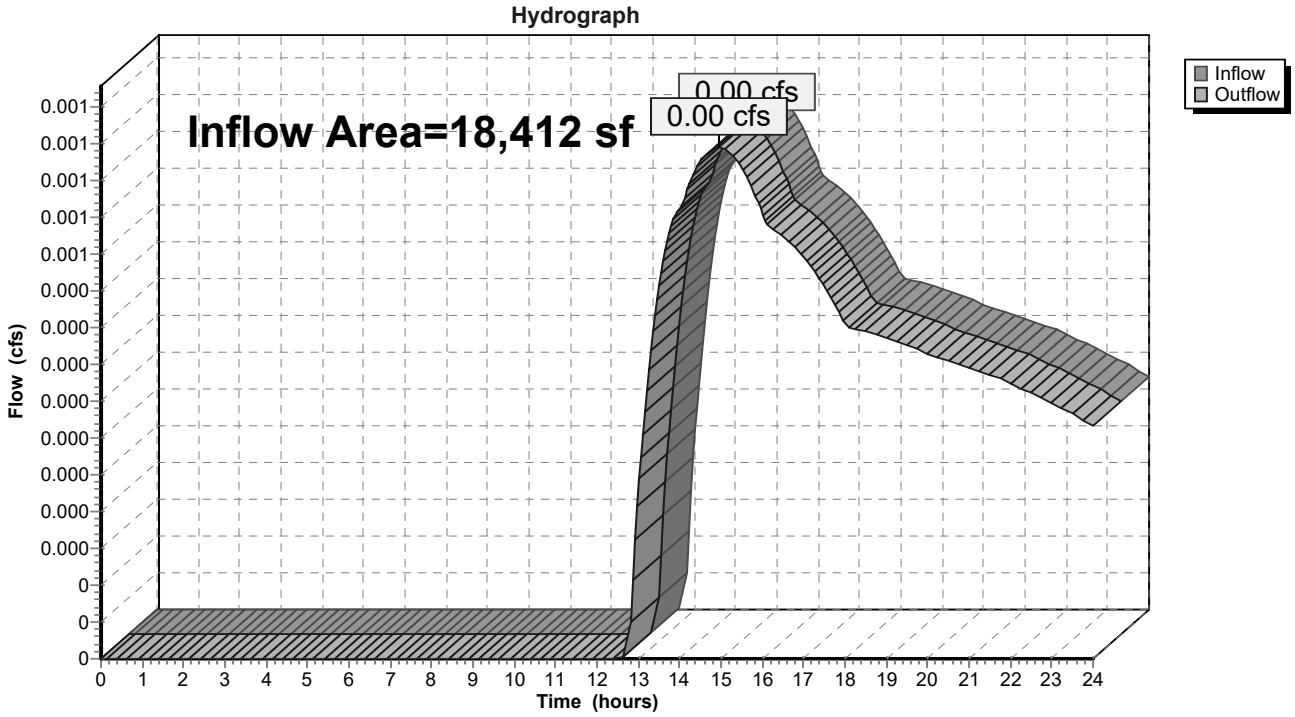


Summary for Reach DP-1: Hillside Ave (east)

Inflow Area = 18,412 sf, 74.28% Impervious, Inflow Depth > 0.01" for 2-year event
Inflow = 0.00 cfs @ 14.94 hrs, Volume= 19 cf
Outflow = 0.00 cfs @ 14.94 hrs, Volume= 19 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Hillside Ave (east)

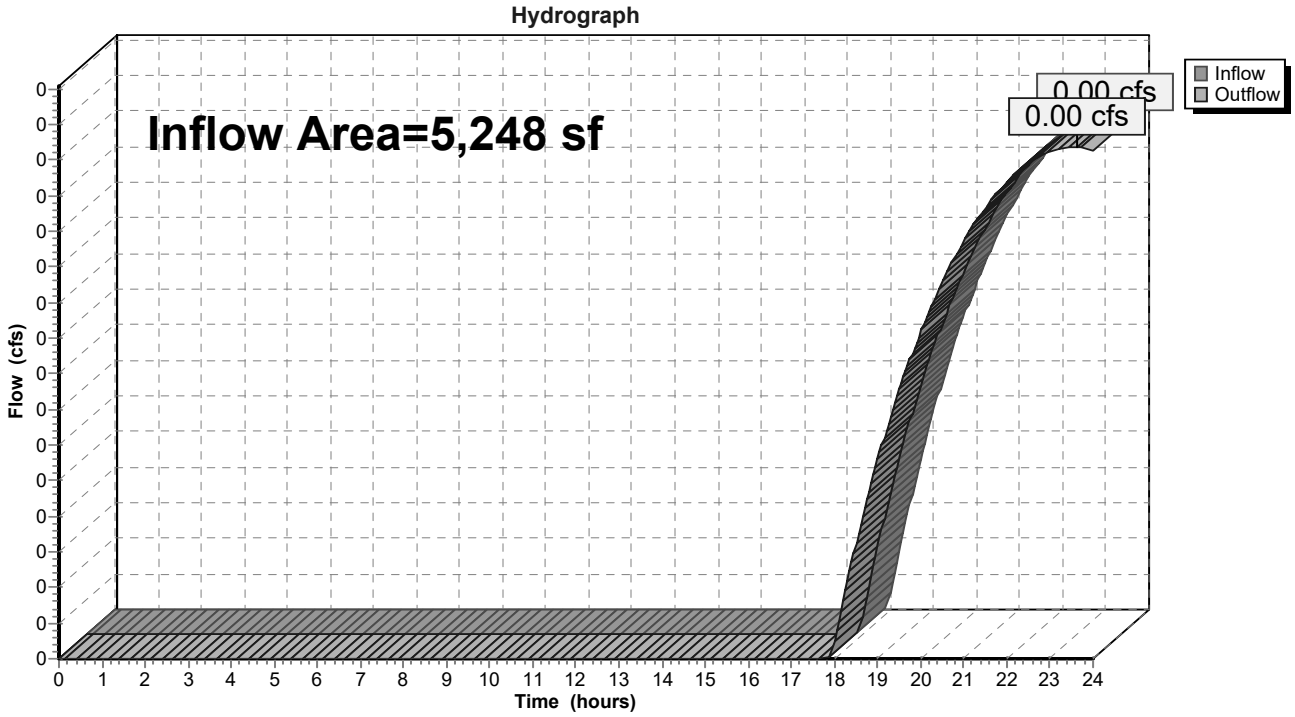


Summary for Reach DP-2: Allenclair Drive

Inflow Area = 5,248 sf, 63.03% Impervious, Inflow Depth > 0.00" for 2-year event
Inflow = 0.00 cfs @ 23.64 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 23.64 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Allenclair Drive



Summary for Pond 1P: Cultec 330XL HD

Inflow Area = 14,968 sf, 88.88% Impervious, Inflow Depth > 2.43" for 2-year event
Inflow = 0.96 cfs @ 12.07 hrs, Volume= 3,026 cf
Outflow = 0.13 cfs @ 11.70 hrs, Volume= 3,022 cf, Atten= 87%, Lag= 0.0 min
Discarded = 0.13 cfs @ 11.70 hrs, Volume= 3,022 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 95.70' @ 12.63 hrs Surf.Area= 2,242 sf Storage= 1,003 cf

Plug-Flow detention time= 57.8 min calculated for 3,022 cf (100% of inflow)
Center-of-Mass det. time= 56.9 min (856.0 - 799.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	94.91'	1,897 cf	**30.50'W x 73.50'L x 3.54'H Field A** 7,940 cf Overall - 3,196 cf Embedded = 4,743 cf x 40.0% Voids
#2A	95.41'	3,196 cf	**Cultec R-330XLHD** x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
#3	98.45'	0 cf	**0.50'D x 1.77'H Vertical Cone/Cylinder**-Impervious
		5,094 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	94.91'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	100.21'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.13 cfs @ 11.70 hrs HW=94.97' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=94.91' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Cultec 330XL HD - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

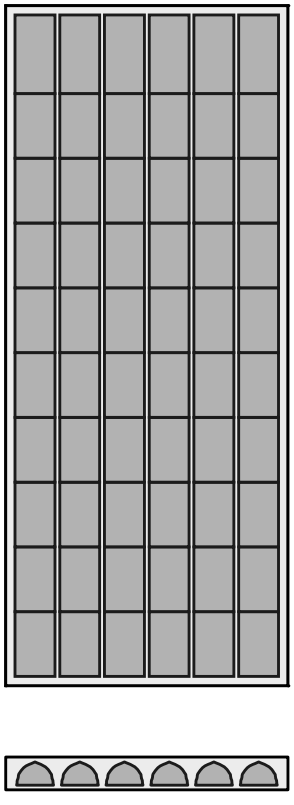
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

60 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 3,196.5 cf Chamber Storage

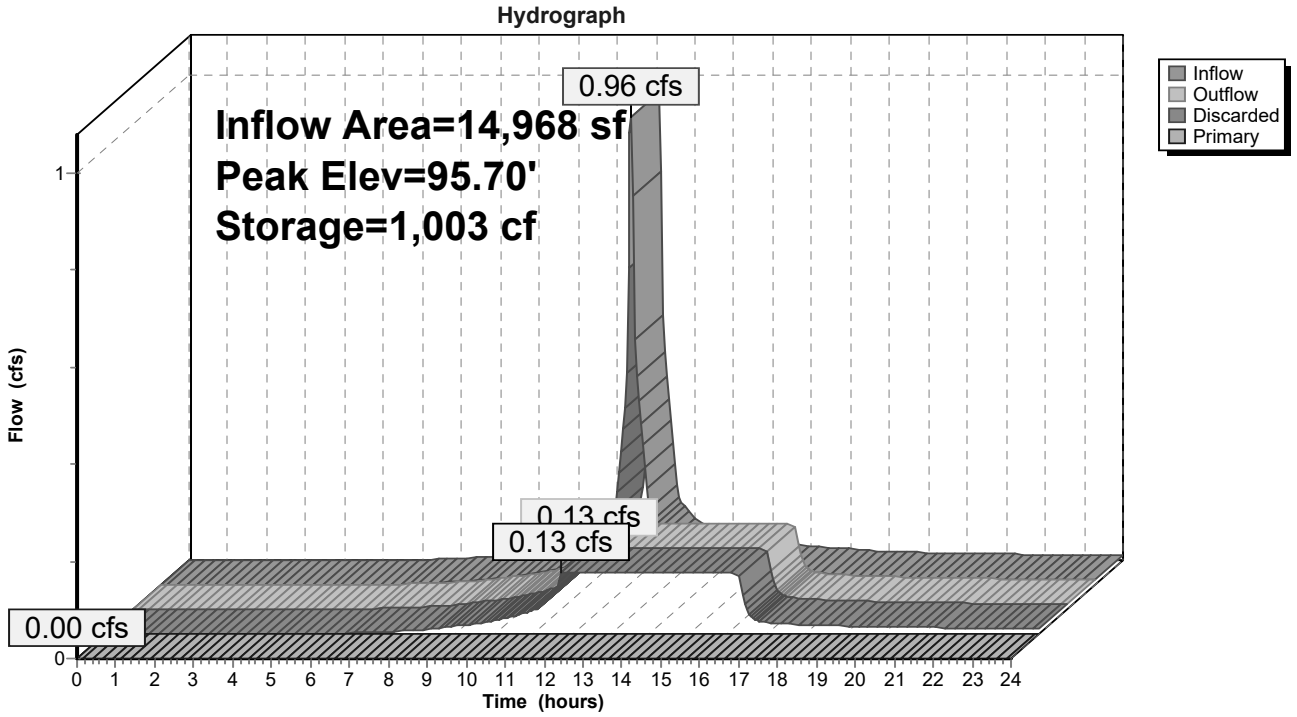
7,939.5 cf Field - 3,196.5 cf Chambers = 4,743.1 cf Stone x 40.0% Voids = 1,897.2 cf Stone Storage

Chamber Storage + Stone Storage = 5,093.7 cf = 0.117 af
Overall Storage Efficiency = 64.2%
Overall System Size = 73.50' x 30.50' x 3.54'

60 Chambers
294.1 cy Field
175.7 cy Stone



Pond 1P: Cultec 330XL HD



Summary for Pond 3P: Cultec 330XL HD

Inflow Area = 3,881 sf, 85.24% Impervious, Inflow Depth > 2.25" for 2-year event
Inflow = 0.23 cfs @ 12.07 hrs, Volume= 726 cf
Outflow = 0.04 cfs @ 11.75 hrs, Volume= 725 cf, Atten= 84%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.75 hrs, Volume= 725 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 95.88' @ 12.57 hrs Surf.Area= 656 sf Storage= 222 cf

Plug-Flow detention time= 41.4 min calculated for 724 cf (100% of inflow)
Center-of-Mass det. time= 40.7 min (848.3 - 807.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.21'	578 cf	**20.83'W x 31.50'L x 3.54'H Field A** 2,324 cf Overall - 879 cf Embedded = 1,445 cf x 40.0% Voids
#2A	95.71'	879 cf	**Cultec R-330XLHD** x 16 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows
#3	98.80'	0 cf	**0.50'D x 1.08'H Vertical Cone/Cylinder**-Impervious
		1,457 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.21'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	99.83'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 11.75 hrs HW=95.26' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.21' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: Cultec 330XL HD - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 4 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

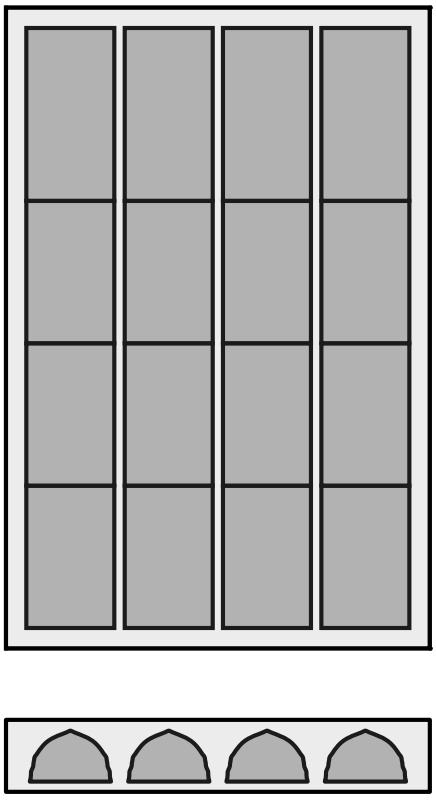
4 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 29.50' Row Length +12.0" End Stone x 2 = 31.50' Base Length
4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

16 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 879.2 cf Chamber Storage

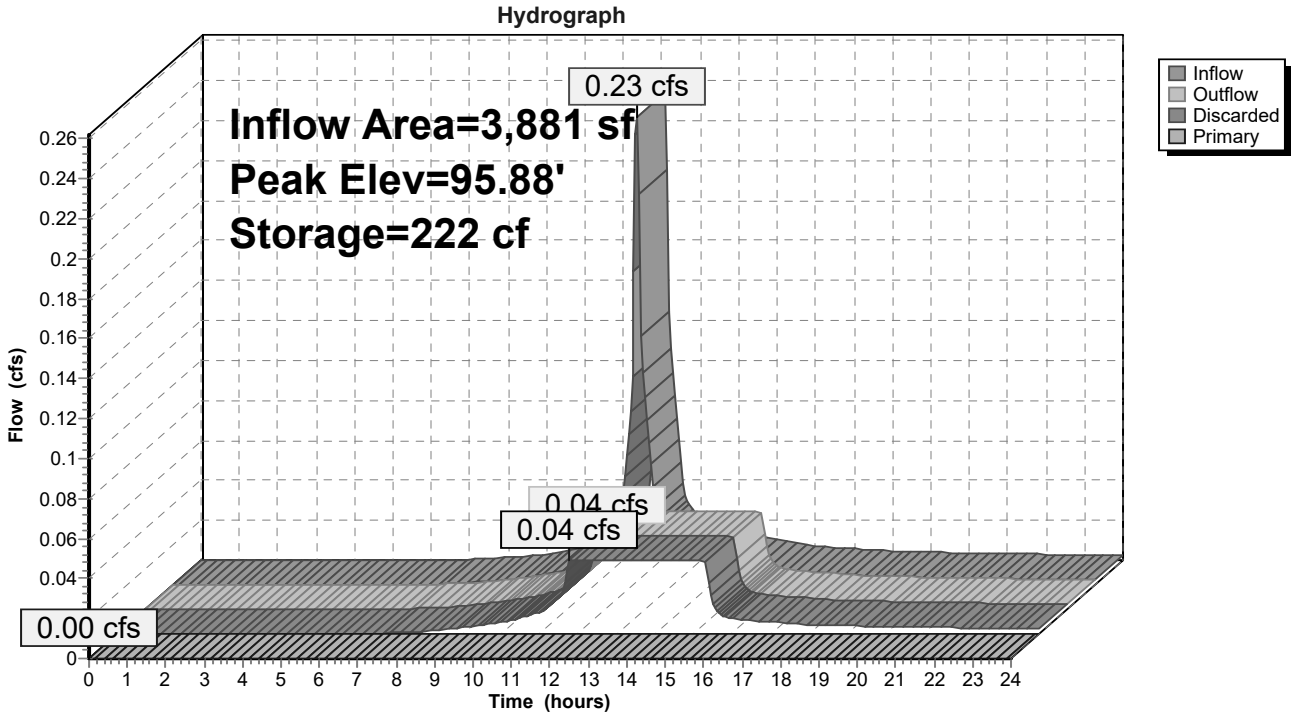
2,324.2 cf Field - 879.2 cf Chambers = 1,445.0 cf Stone x 40.0% Voids = 578.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,457.2 cf = 0.033 af
Overall Storage Efficiency = 62.7%
Overall System Size = 31.50' x 20.83' x 3.54'

16 Chambers
86.1 cy Field
53.5 cy Stone



Pond 3P: Cultec 330XL HD



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1: PWS-1 Runoff Area=14,968 sf 88.88% Impervious Runoff Depth>4.32"
Tc=5.0 min CN=91 Runoff=1.67 cfs 5,389 cf

Subcatchment PWS-2: PWS-2 Runoff Area=3,444 sf 10.80% Impervious Runoff Depth>0.56"
Tc=5.0 min CN=45 Runoff=0.02 cfs 160 cf

Subcatchment PWS-3: PWS-3 Runoff Area=3,881 sf 85.24% Impervious Runoff Depth>4.11"
Tc=5.0 min CN=89 Runoff=0.42 cfs 1,328 cf

Subcatchment PWS-4: PWS-4 Runoff Area=1,367 sf 0.00% Impervious Runoff Depth>0.28"
Tc=5.0 min CN=39 Runoff=0.00 cfs 31 cf

Reach DP-1: Hillside Ave (east) Inflow=0.02 cfs 160 cf
Outflow=0.02 cfs 160 cf

Reach DP-2: Allenclair Drive Inflow=0.00 cfs 31 cf
Outflow=0.00 cfs 31 cf

Pond 1P: Cultec 330XL HD Peak Elev=96.33' Storage=2,171 cf Inflow=1.67 cfs 5,389 cf
Discarded=0.13 cfs 5,382 cf Primary=0.00 cfs 0 cf Outflow=0.13 cfs 5,382 cf

Pond 3P: Cultec 330XL HD Peak Elev=96.41' Storage=508 cf Inflow=0.42 cfs 1,328 cf
Discarded=0.04 cfs 1,326 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 1,326 cf

Total Runoff Area = 23,660 sf Runoff Volume = 6,908 cf Average Runoff Depth = 3.50"
28.22% Pervious = 6,676 sf 71.78% Impervious = 16,984 sf

Summary for Subcatchment PWS-1: PWS-1

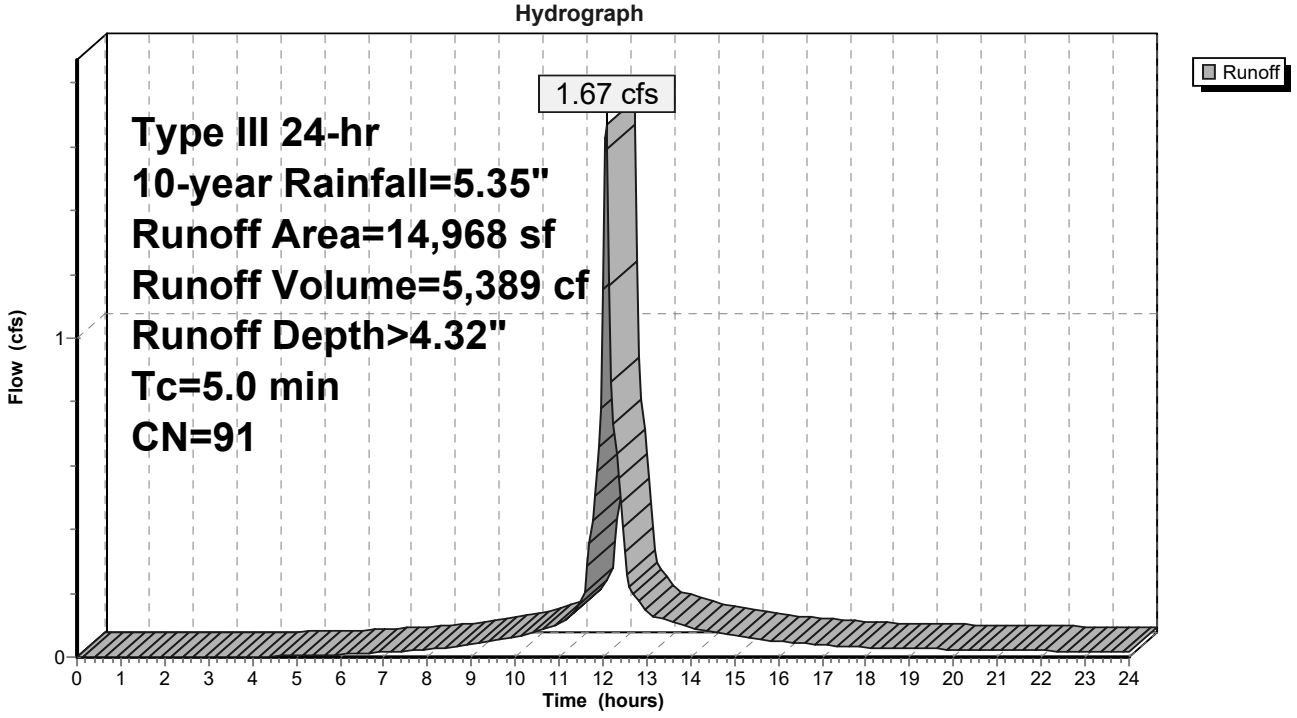
Runoff = 1.67 cfs @ 12.07 hrs, Volume= 5,389 cf, Depth> 4.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.35"

Area (sf)	CN	Description
8,635	98	Paved parking, HSG A
4,669	98	Roofs, HSG A
1,664	39	>75% Grass cover, Good, HSG A
14,968	91	Weighted Average
1,664		11.12% Pervious Area
13,304		88.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-1: PWS-1



Summary for Subcatchment PWS-2: PWS-2

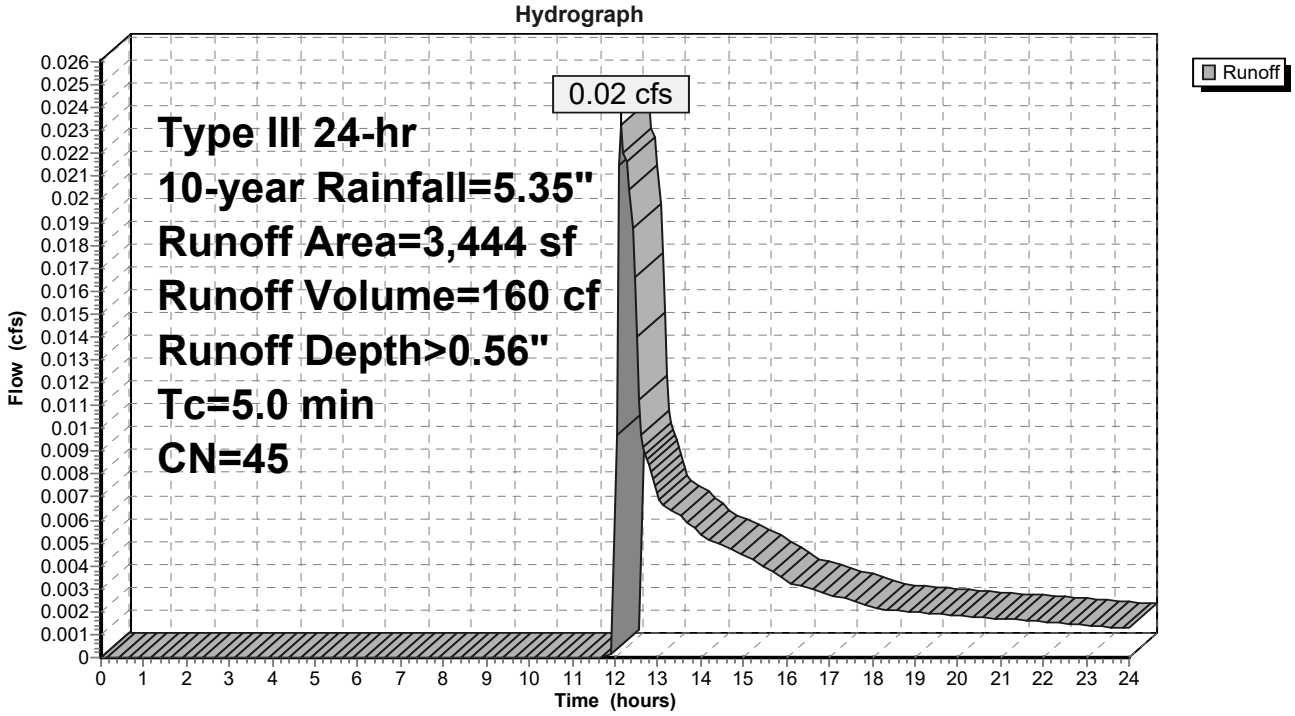
Runoff = 0.02 cfs @ 12.15 hrs, Volume= 160 cf, Depth> 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.35"

Area (sf)	CN	Description
3,072	39	>75% Grass cover, Good, HSG A
372	98	Paved roads w/curbs & sewers, HSG A
3,444	45	Weighted Average
3,072		89.20% Pervious Area
372		10.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-2: PWS-2



Summary for Subcatchment PWS-3: PWS-3

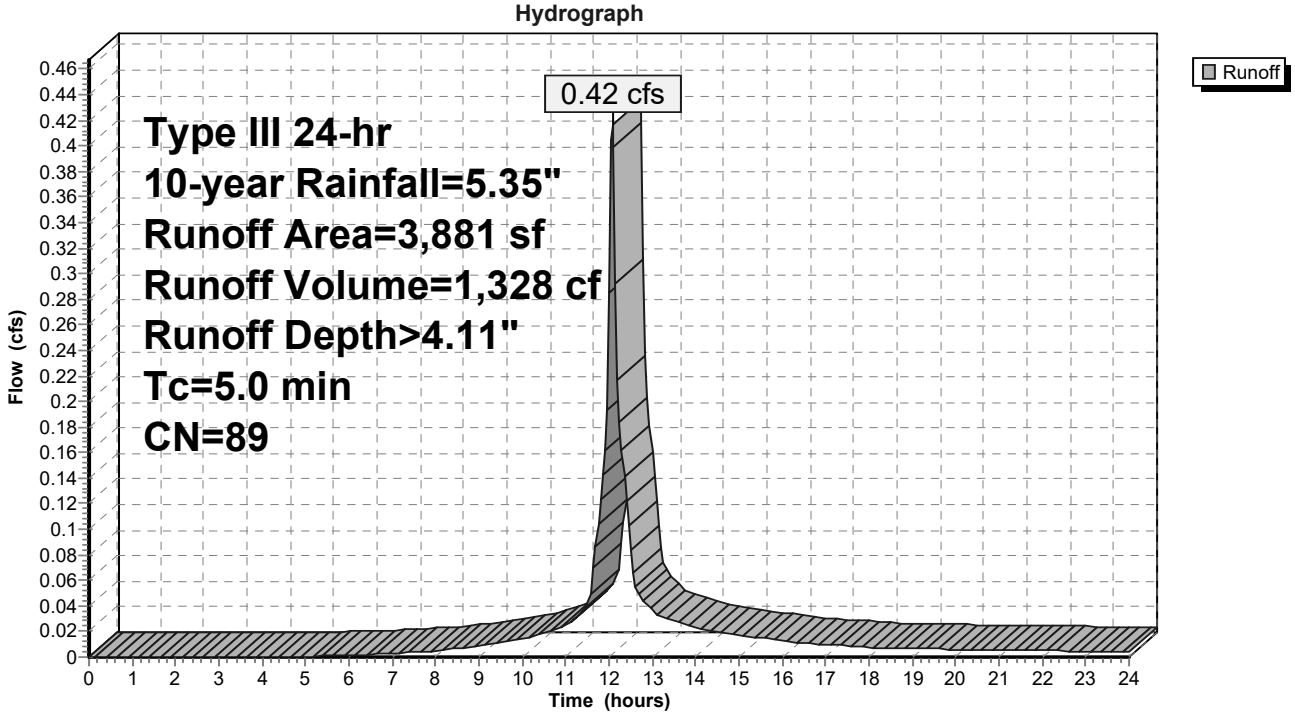
Runoff = 0.42 cfs @ 12.07 hrs, Volume= 1,328 cf, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.35"

	Area (sf)	CN	Description
	573	39	>75% Grass cover, Good, HSG A
	3,290	98	Paved parking, HSG A
*	18	98	Walk, HSG A
	3,881	89	Weighted Average
	573		14.76% Pervious Area
	3,308		85.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-3: PWS-3



Summary for Subcatchment PWS-4: PWS-4

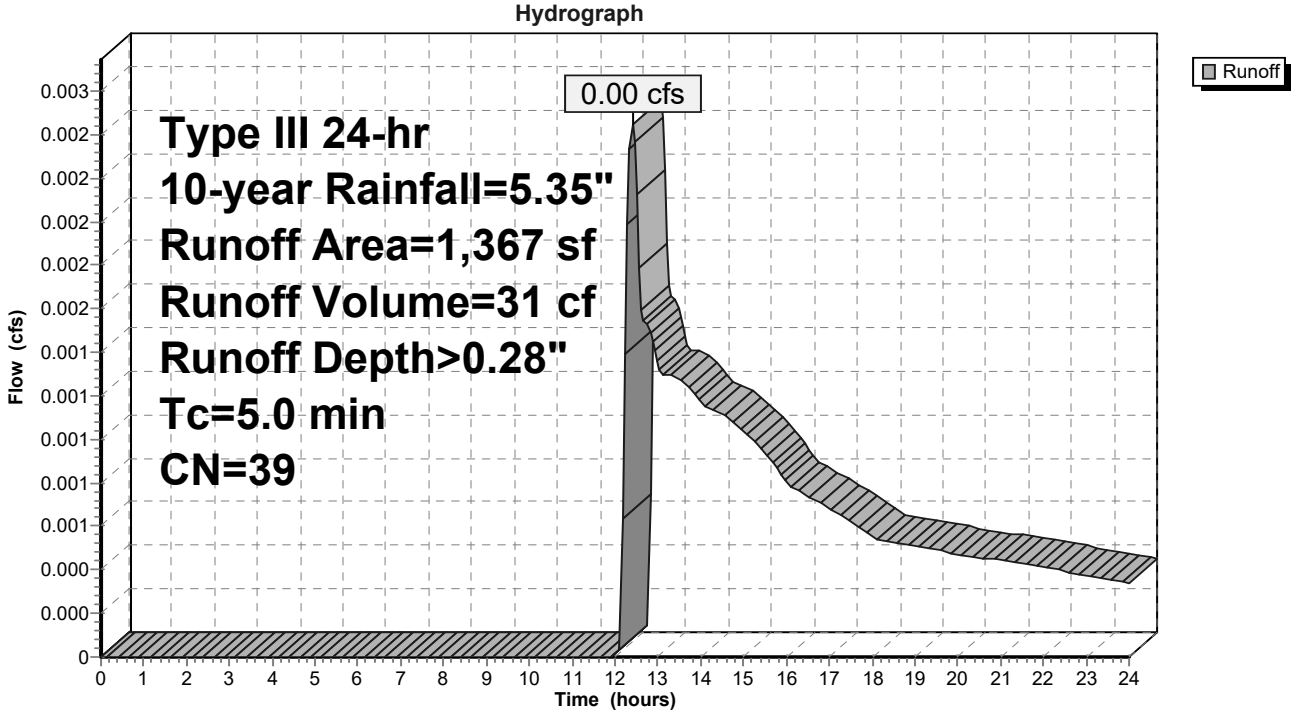
Runoff = 0.00 cfs @ 12.40 hrs, Volume= 31 cf, Depth> 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=5.35"

Area (sf)	CN	Description
1,367	39	>75% Grass cover, Good, HSG A
1,367		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-4: PWS-4

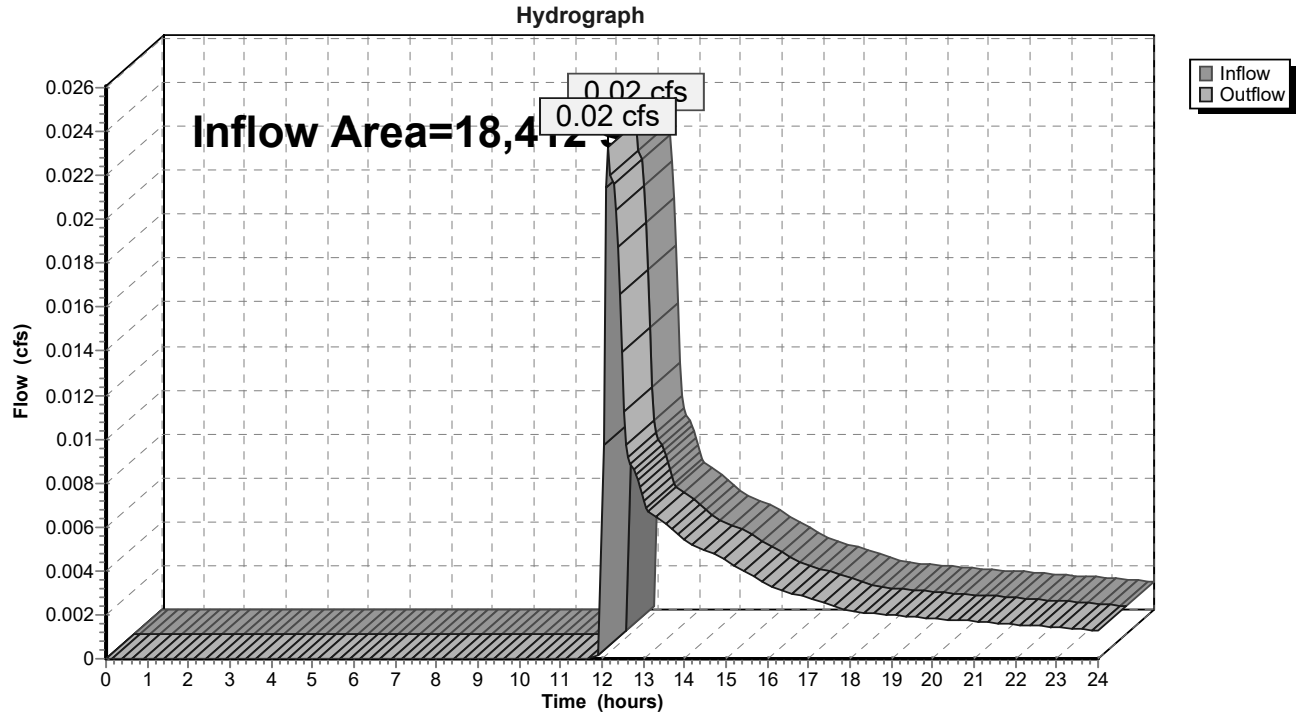


Summary for Reach DP-1: Hillside Ave (east)

Inflow Area = 18,412 sf, 74.28% Impervious, Inflow Depth > 0.10" for 10-year event
Inflow = 0.02 cfs @ 12.15 hrs, Volume= 160 cf
Outflow = 0.02 cfs @ 12.15 hrs, Volume= 160 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Hillside Ave (east)

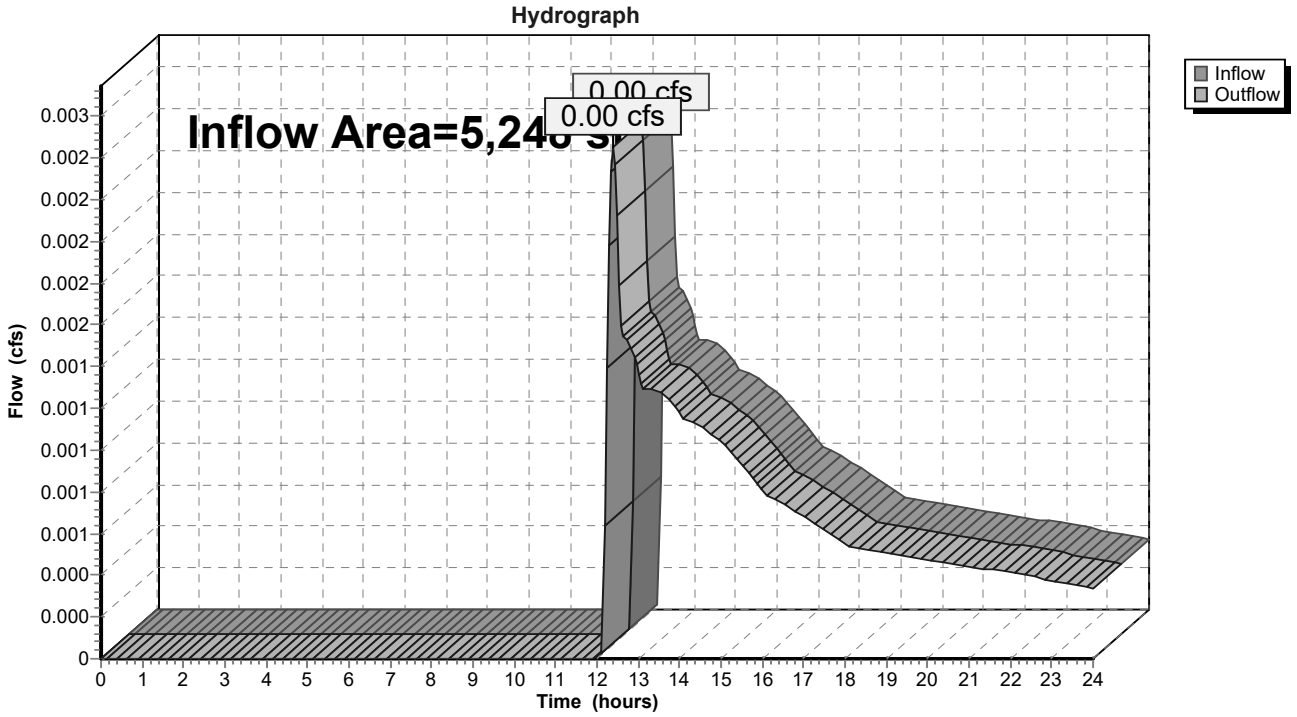


Summary for Reach DP-2: Allenclair Drive

Inflow Area = 5,248 sf, 63.03% Impervious, Inflow Depth > 0.07" for 10-year event
Inflow = 0.00 cfs @ 12.40 hrs, Volume= 31 cf
Outflow = 0.00 cfs @ 12.40 hrs, Volume= 31 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Allenclair Drive



Summary for Pond 1P: Cultec 330XL HD

Inflow Area = 14,968 sf, 88.88% Impervious, Inflow Depth > 4.32" for 10-year event
Inflow = 1.67 cfs @ 12.07 hrs, Volume= 5,389 cf
Outflow = 0.13 cfs @ 11.35 hrs, Volume= 5,382 cf, Atten= 93%, Lag= 0.0 min
Discarded = 0.13 cfs @ 11.35 hrs, Volume= 5,382 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 96.33' @ 13.19 hrs Surf.Area= 2,242 sf Storage= 2,171 cf

Plug-Flow detention time= 141.1 min calculated for 5,382 cf (100% of inflow)
Center-of-Mass det. time= 140.3 min (923.7 - 783.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	94.91'	1,897 cf	**30.50'W x 73.50'L x 3.54'H Field A** 7,940 cf Overall - 3,196 cf Embedded = 4,743 cf x 40.0% Voids
#2A	95.41'	3,196 cf	**Cultec R-330XLHD** x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
#3	98.45'	0 cf	**0.50'D x 1.77'H Vertical Cone/Cylinder**-Impervious
		5,094 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	94.91'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	100.21'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.13 cfs @ 11.35 hrs HW=94.97' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=94.91' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Cultec 330XL HD - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

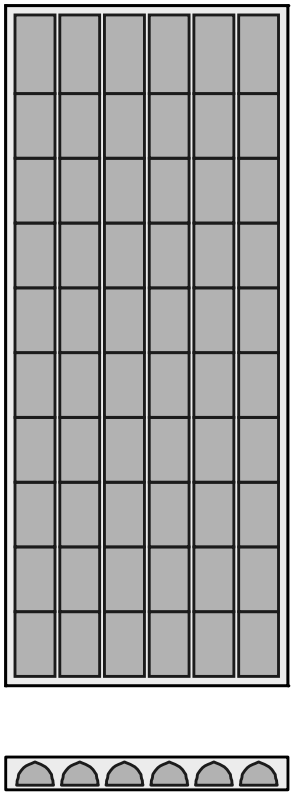
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

60 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 3,196.5 cf Chamber Storage

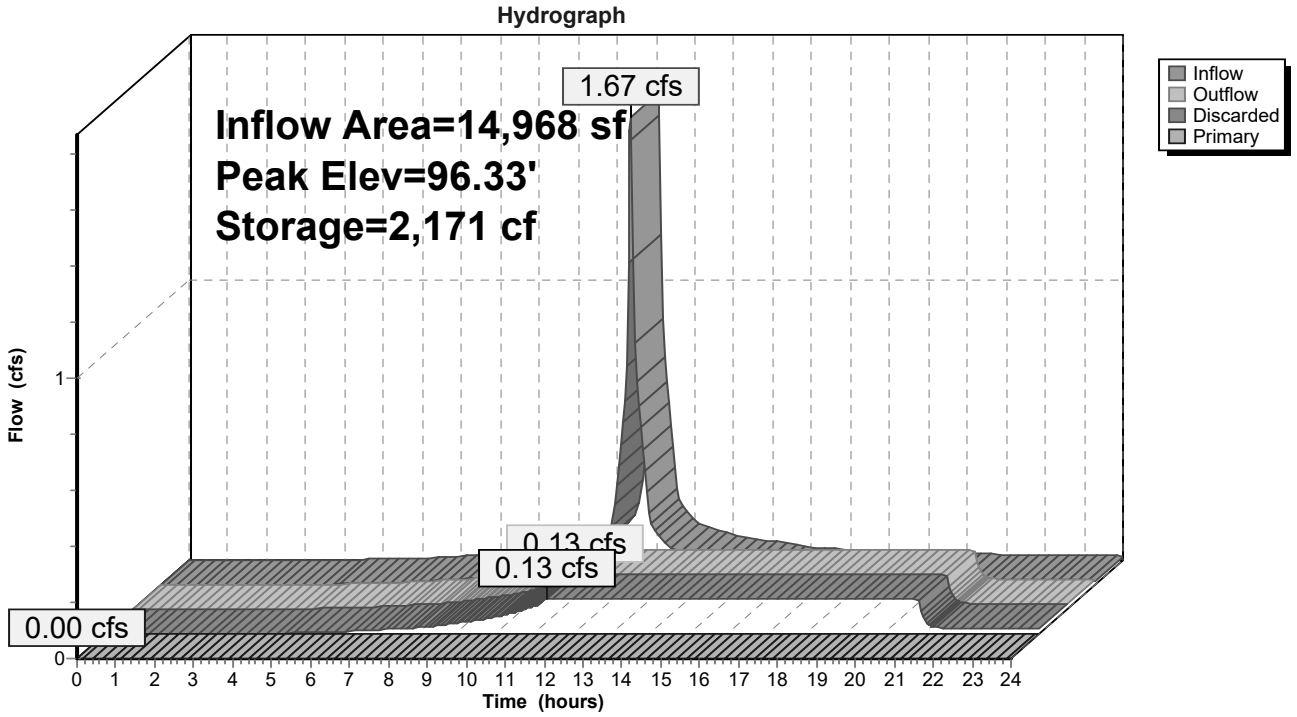
7,939.5 cf Field - 3,196.5 cf Chambers = 4,743.1 cf Stone x 40.0% Voids = 1,897.2 cf Stone Storage

Chamber Storage + Stone Storage = 5,093.7 cf = 0.117 af
Overall Storage Efficiency = 64.2%
Overall System Size = 73.50' x 30.50' x 3.54'

60 Chambers
294.1 cy Field
175.7 cy Stone



Pond 1P: Cultec 330XL HD



Summary for Pond 3P: Cultec 330XL HD

Inflow Area = 3,881 sf, 85.24% Impervious, Inflow Depth > 4.11" for 10-year event
Inflow = 0.42 cfs @ 12.07 hrs, Volume= 1,328 cf
Outflow = 0.04 cfs @ 11.50 hrs, Volume= 1,326 cf, Atten= 91%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.50 hrs, Volume= 1,326 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 96.41' @ 12.99 hrs Surf.Area= 656 sf Storage= 508 cf

Plug-Flow detention time= 109.7 min calculated for 1,324 cf (100% of inflow)
Center-of-Mass det. time= 108.8 min (899.5 - 790.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.21'	578 cf	**20.83'W x 31.50'L x 3.54'H Field A** 2,324 cf Overall - 879 cf Embedded = 1,445 cf x 40.0% Voids
#2A	95.71'	879 cf	**Cultec R-330XLHD** x 16 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows
#3	98.80'	0 cf	**0.50'D x 1.08'H Vertical Cone/Cylinder**-Impervious
		1,457 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.21'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	99.83'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 11.50 hrs HW=95.26' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.21' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: Cultec 330XL HD - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 4 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

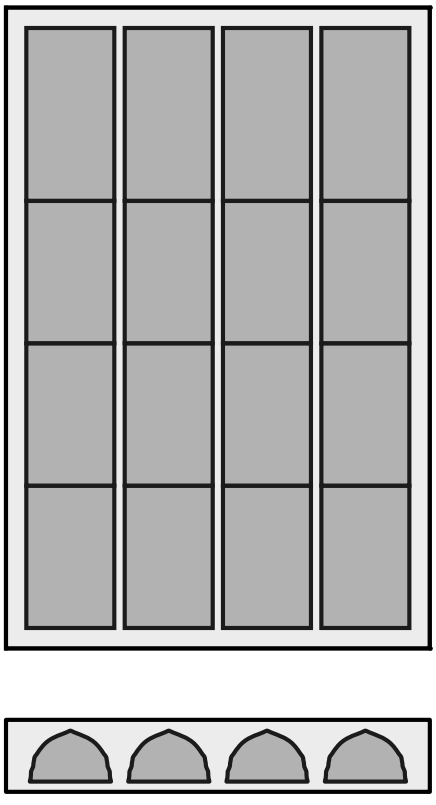
4 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 29.50' Row Length +12.0" End Stone x 2 = 31.50' Base Length
4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

16 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 879.2 cf Chamber Storage

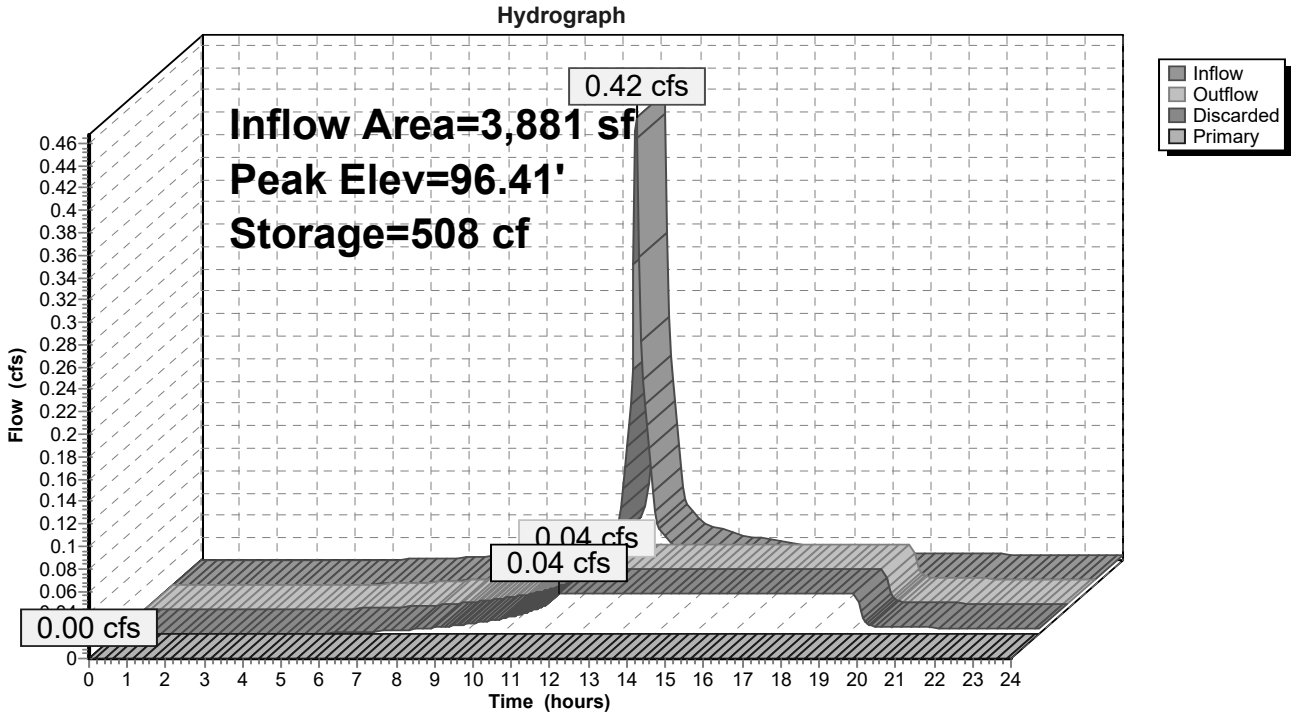
2,324.2 cf Field - 879.2 cf Chambers = 1,445.0 cf Stone x 40.0% Voids = 578.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,457.2 cf = 0.033 af
Overall Storage Efficiency = 62.7%
Overall System Size = 31.50' x 20.83' x 3.54'

16 Chambers
86.1 cy Field
53.5 cy Stone



Pond 3P: Cultec 330XL HD



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1: PWS-1 Runoff Area=14,968 sf 88.88% Impervious Runoff Depth>5.52"
Tc=5.0 min CN=91 Runoff=2.11 cfs 6,889 cf

Subcatchment PWS-2: PWS-2 Runoff Area=3,444 sf 10.80% Impervious Runoff Depth>1.04"
Tc=5.0 min CN=45 Runoff=0.07 cfs 300 cf

Subcatchment PWS-3: PWS-3 Runoff Area=3,881 sf 85.24% Impervious Runoff Depth>5.30"
Tc=5.0 min CN=89 Runoff=0.53 cfs 1,713 cf

Subcatchment PWS-4: PWS-4 Runoff Area=1,367 sf 0.00% Impervious Runoff Depth>0.62"
Tc=5.0 min CN=39 Runoff=0.01 cfs 71 cf

Reach DP-1: Hillside Ave (east) Inflow=0.07 cfs 300 cf
Outflow=0.07 cfs 300 cf

Reach DP-2: Allenclair Drive Inflow=0.01 cfs 71 cf
Outflow=0.01 cfs 71 cf

Pond 1P: Cultec 330XL HD Peak Elev=96.80' Storage=3,018 cf Inflow=2.11 cfs 6,889 cf
Discarded=0.13 cfs 6,845 cf Primary=0.00 cfs 0 cf Outflow=0.13 cfs 6,845 cf

Pond 3P: Cultec 330XL HD Peak Elev=96.81' Storage=712 cf Inflow=0.53 cfs 1,713 cf
Discarded=0.04 cfs 1,711 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 1,711 cf

Total Runoff Area = 23,660 sf Runoff Volume = 8,972 cf Average Runoff Depth = 4.55"
28.22% Pervious = 6,676 sf 71.78% Impervious = 16,984 sf

Summary for Subcatchment PWS-1: PWS-1

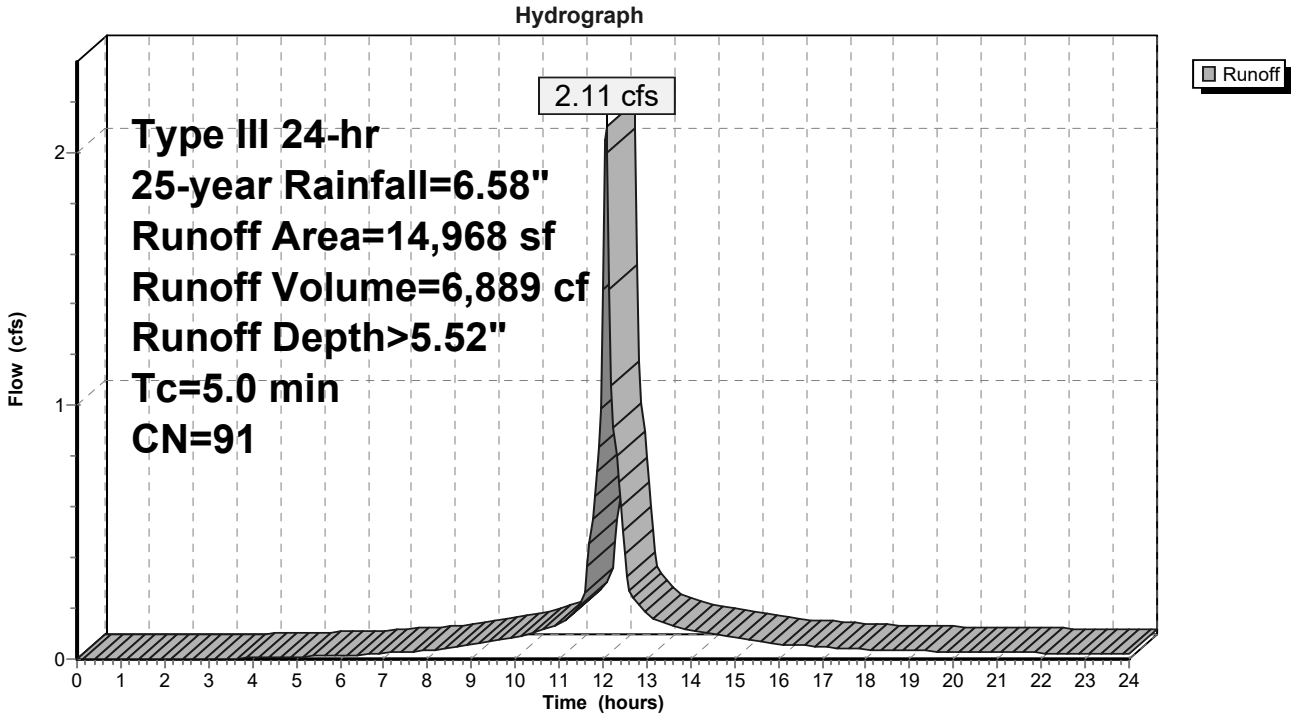
Runoff = 2.11 cfs @ 12.07 hrs, Volume= 6,889 cf, Depth> 5.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.58"

Area (sf)	CN	Description
8,635	98	Paved parking, HSG A
4,669	98	Roofs, HSG A
1,664	39	>75% Grass cover, Good, HSG A
14,968	91	Weighted Average
1,664		11.12% Pervious Area
13,304		88.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-1: PWS-1



Summary for Subcatchment PWS-2: PWS-2

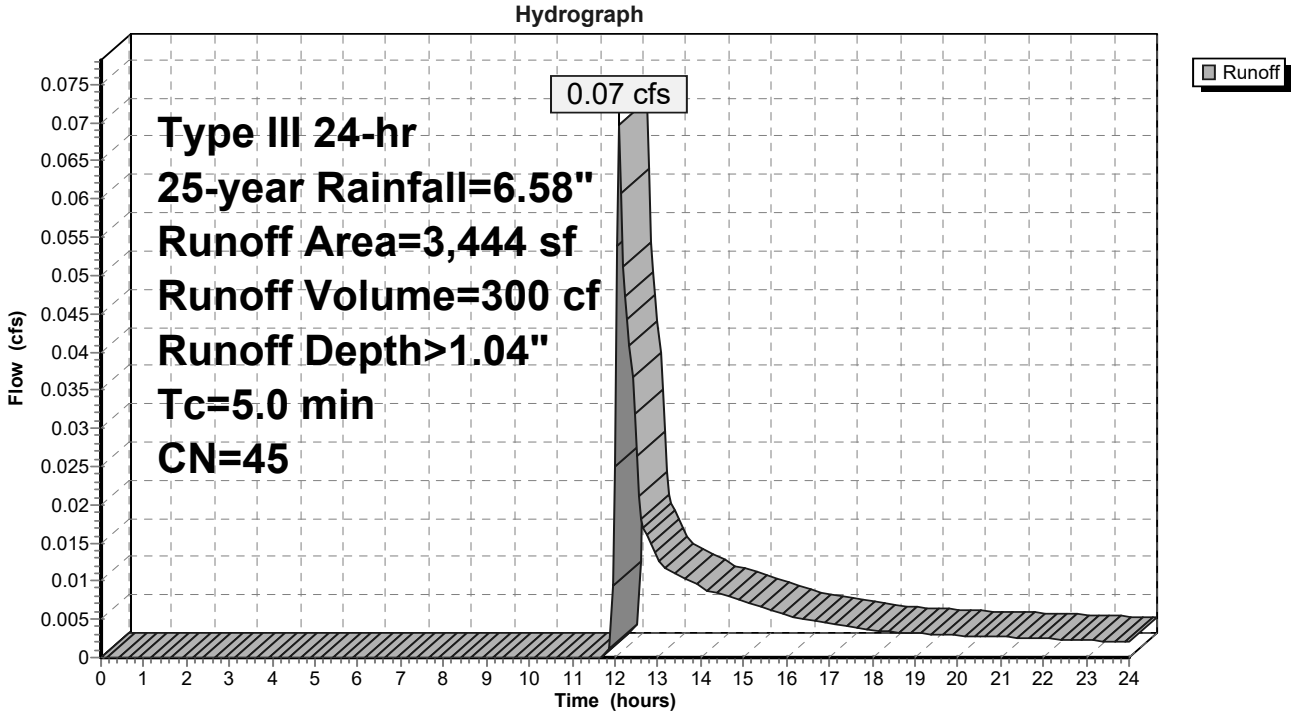
Runoff = 0.07 cfs @ 12.11 hrs, Volume= 300 cf, Depth> 1.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.58"

Area (sf)	CN	Description
3,072	39	>75% Grass cover, Good, HSG A
372	98	Paved roads w/curbs & sewers, HSG A
3,444	45	Weighted Average
3,072		89.20% Pervious Area
372		10.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-2: PWS-2



Summary for Subcatchment PWS-3: PWS-3

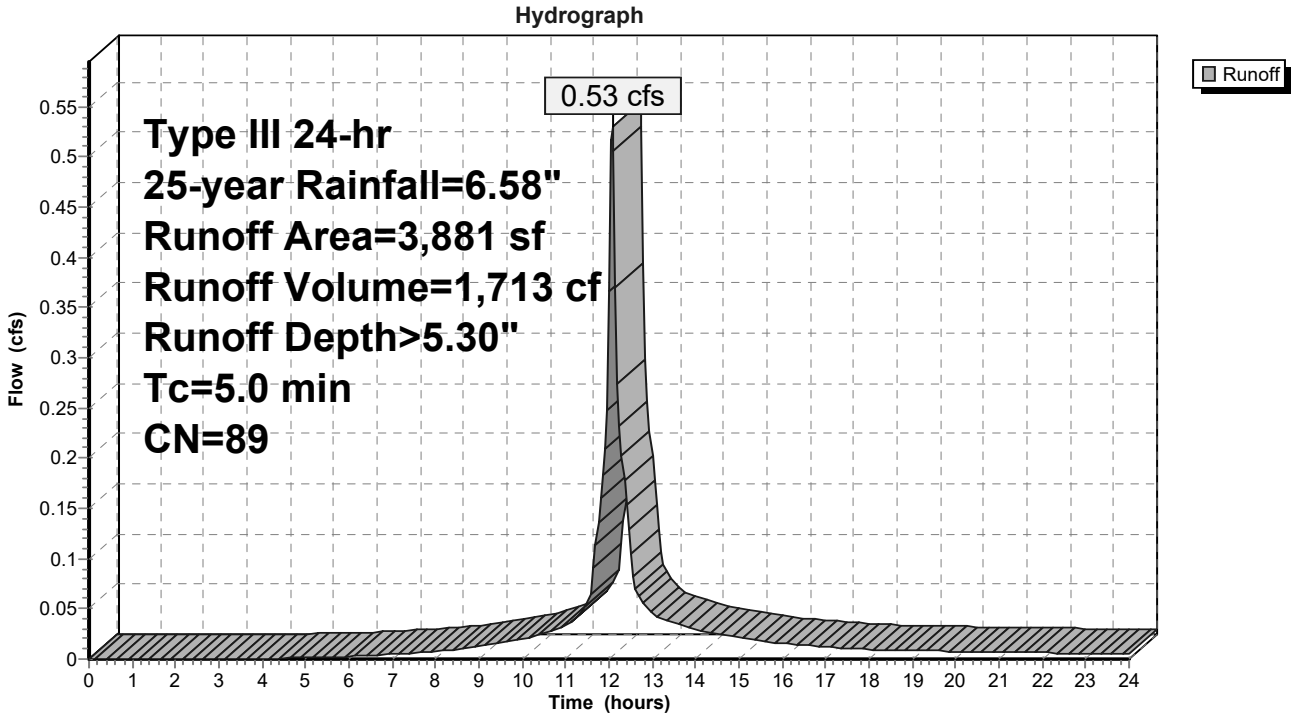
Runoff = 0.53 cfs @ 12.07 hrs, Volume= 1,713 cf, Depth> 5.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.58"

	Area (sf)	CN	Description
	573	39	>75% Grass cover, Good, HSG A
	3,290	98	Paved parking, HSG A
*	18	98	Walk, HSG A
	3,881	89	Weighted Average
	573		14.76% Pervious Area
	3,308		85.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-3: PWS-3



Summary for Subcatchment PWS-4: PWS-4

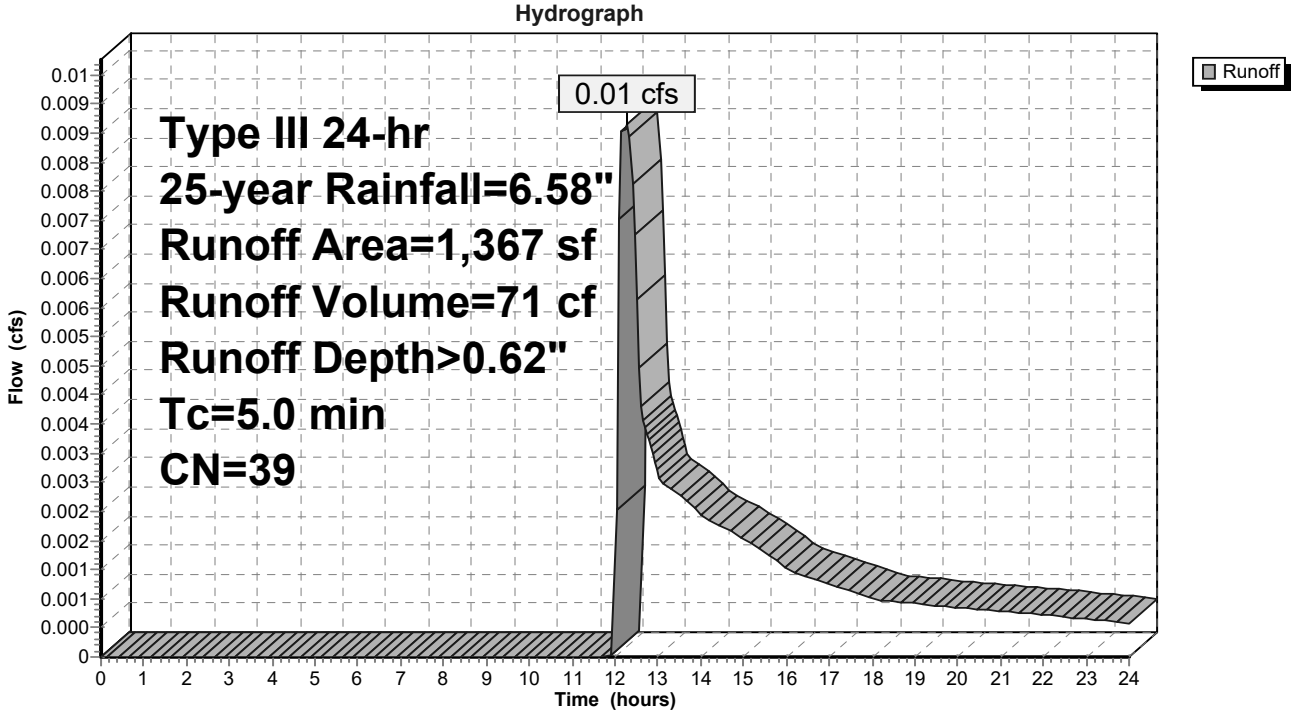
Runoff = 0.01 cfs @ 12.27 hrs, Volume= 71 cf, Depth> 0.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=6.58"

Area (sf)	CN	Description
1,367	39	>75% Grass cover, Good, HSG A
1,367		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-4: PWS-4

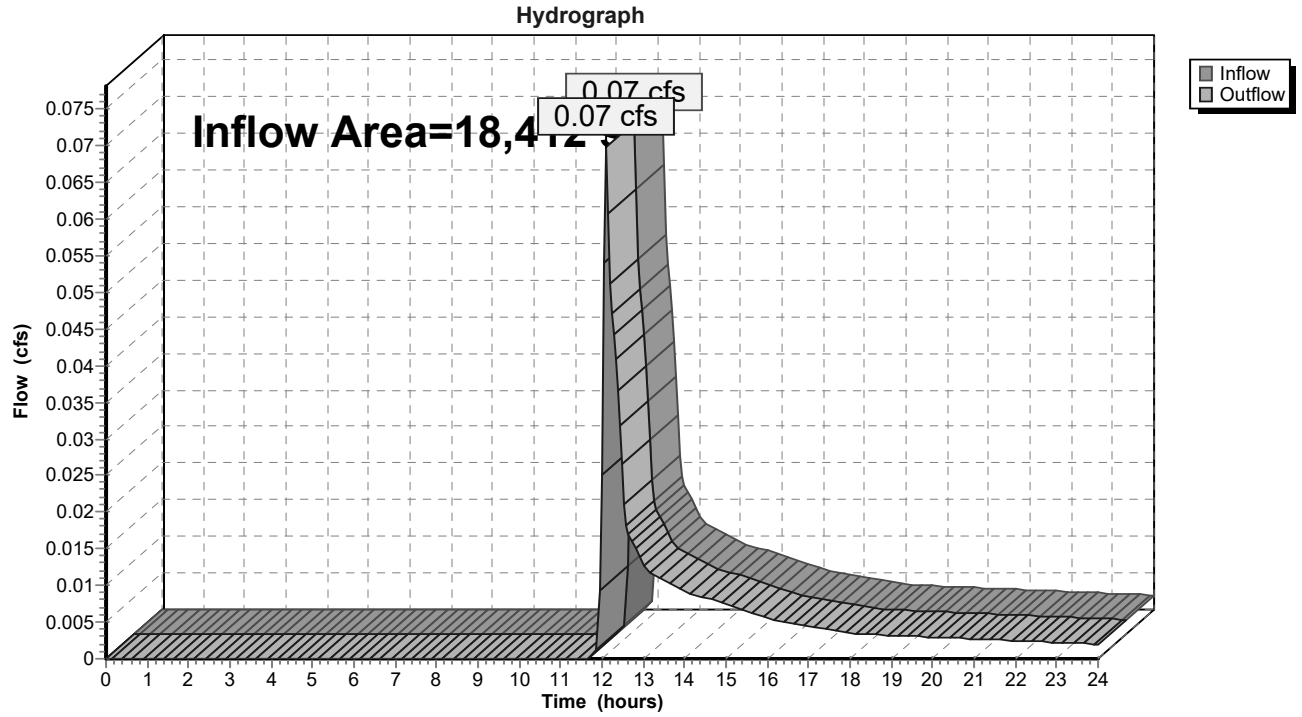


Summary for Reach DP-1: Hillside Ave (east)

Inflow Area = 18,412 sf, 74.28% Impervious, Inflow Depth > 0.20" for 25-year event
Inflow = 0.07 cfs @ 12.11 hrs, Volume= 300 cf
Outflow = 0.07 cfs @ 12.11 hrs, Volume= 300 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Hillside Ave (east)

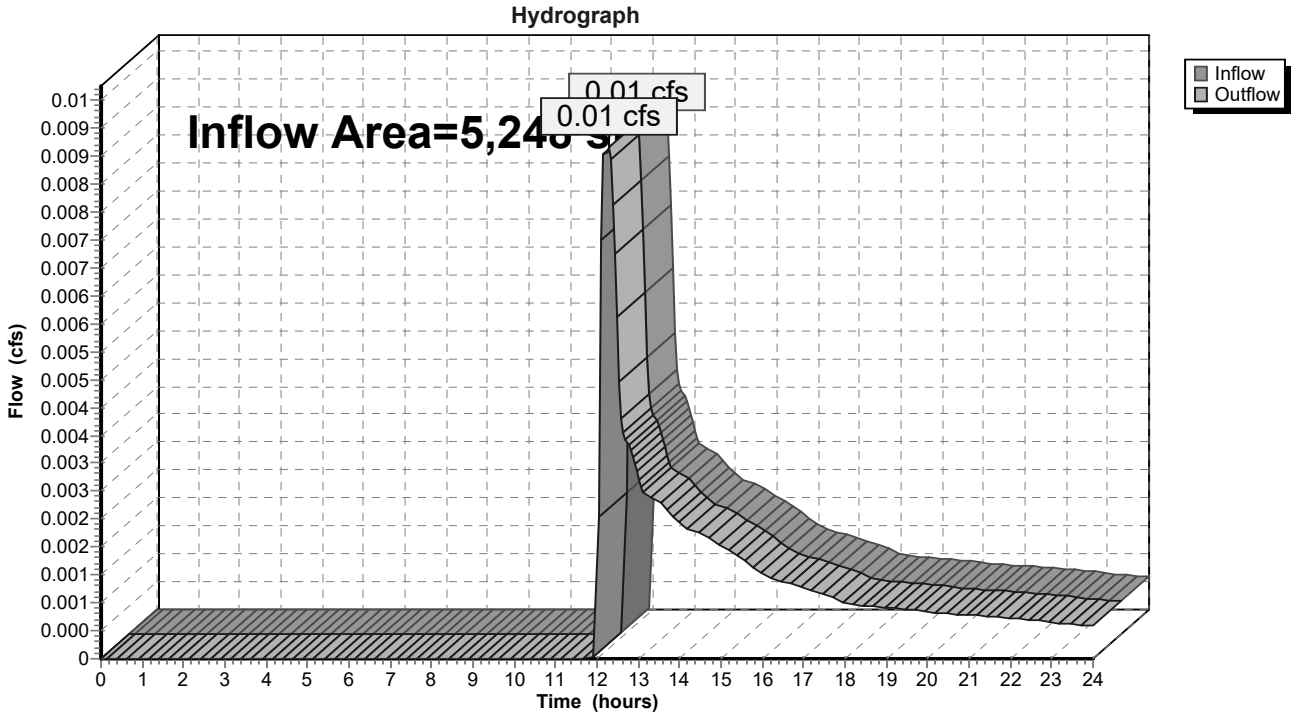


Summary for Reach DP-2: Allenclair Drive

Inflow Area = 5,248 sf, 63.03% Impervious, Inflow Depth > 0.16" for 25-year event
Inflow = 0.01 cfs @ 12.27 hrs, Volume= 71 cf
Outflow = 0.01 cfs @ 12.27 hrs, Volume= 71 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Allenclair Drive



Summary for Pond 1P: Cultec 330XL HD

Inflow Area = 14,968 sf, 88.88% Impervious, Inflow Depth > 5.52" for 25-year event
Inflow = 2.11 cfs @ 12.07 hrs, Volume= 6,889 cf
Outflow = 0.13 cfs @ 10.95 hrs, Volume= 6,845 cf, Atten= 94%, Lag= 0.0 min
Discarded = 0.13 cfs @ 10.95 hrs, Volume= 6,845 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 96.80' @ 13.77 hrs Surf.Area= 2,242 sf Storage= 3,018 cf

Plug-Flow detention time= 205.7 min calculated for 6,831 cf (99% of inflow)
Center-of-Mass det. time= 201.2 min (978.2 - 777.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	94.91'	1,897 cf	**30.50'W x 73.50'L x 3.54'H Field A** 7,940 cf Overall - 3,196 cf Embedded = 4,743 cf x 40.0% Voids
#2A	95.41'	3,196 cf	**Cultec R-330XLHD** x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
#3	98.45'	0 cf	**0.50'D x 1.77'H Vertical Cone/Cylinder**-Impervious
		5,094 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	94.91'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	100.21'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.13 cfs @ 10.95 hrs HW=94.97' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=94.91' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Cultec 330XL HD - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

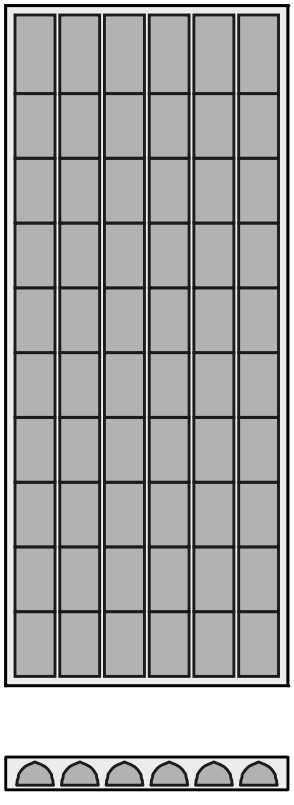
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

60 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 3,196.5 cf Chamber Storage

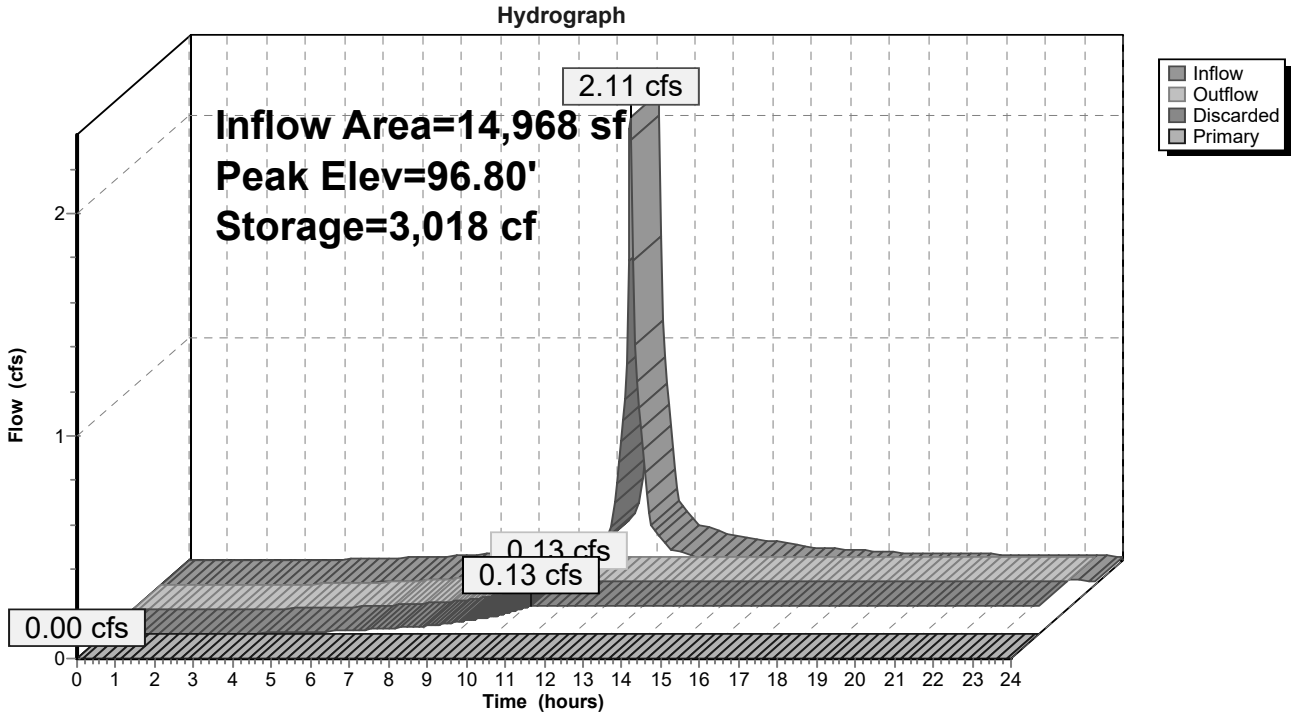
7,939.5 cf Field - 3,196.5 cf Chambers = 4,743.1 cf Stone x 40.0% Voids = 1,897.2 cf Stone Storage

Chamber Storage + Stone Storage = 5,093.7 cf = 0.117 af
Overall Storage Efficiency = 64.2%
Overall System Size = 73.50' x 30.50' x 3.54'

60 Chambers
294.1 cy Field
175.7 cy Stone



Pond 1P: Cultec 330XL HD



Summary for Pond 3P: Cultec 330XL HD

Inflow Area = 3,881 sf, 85.24% Impervious, Inflow Depth > 5.30" for 25-year event
Inflow = 0.53 cfs @ 12.07 hrs, Volume= 1,713 cf
Outflow = 0.04 cfs @ 11.25 hrs, Volume= 1,711 cf, Atten= 93%, Lag= 0.0 min
Discarded = 0.04 cfs @ 11.25 hrs, Volume= 1,711 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 96.81' @ 13.43 hrs Surf.Area= 656 sf Storage= 712 cf

Plug-Flow detention time= 161.9 min calculated for 1,707 cf (100% of inflow)
Center-of-Mass det. time= 160.8 min (944.7 - 783.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.21'	578 cf	**20.83'W x 31.50'L x 3.54'H Field A** 2,324 cf Overall - 879 cf Embedded = 1,445 cf x 40.0% Voids
#2A	95.71'	879 cf	**Cultec R-330XLHD** x 16 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows
#3	98.80'	0 cf	**0.50'D x 1.08'H Vertical Cone/Cylinder**-Impervious
		1,457 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.21'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	99.83'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 11.25 hrs HW=95.26' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.21' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: Cultec 330XL HD - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 4 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

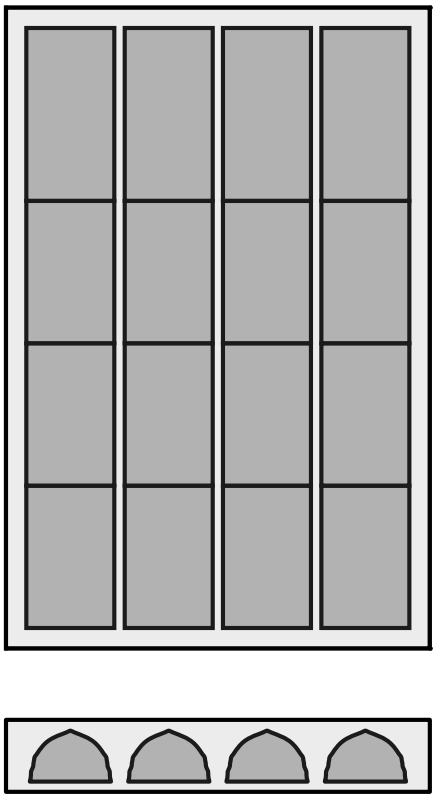
4 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 29.50' Row Length +12.0" End Stone x 2 = 31.50' Base Length
4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

16 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 879.2 cf Chamber Storage

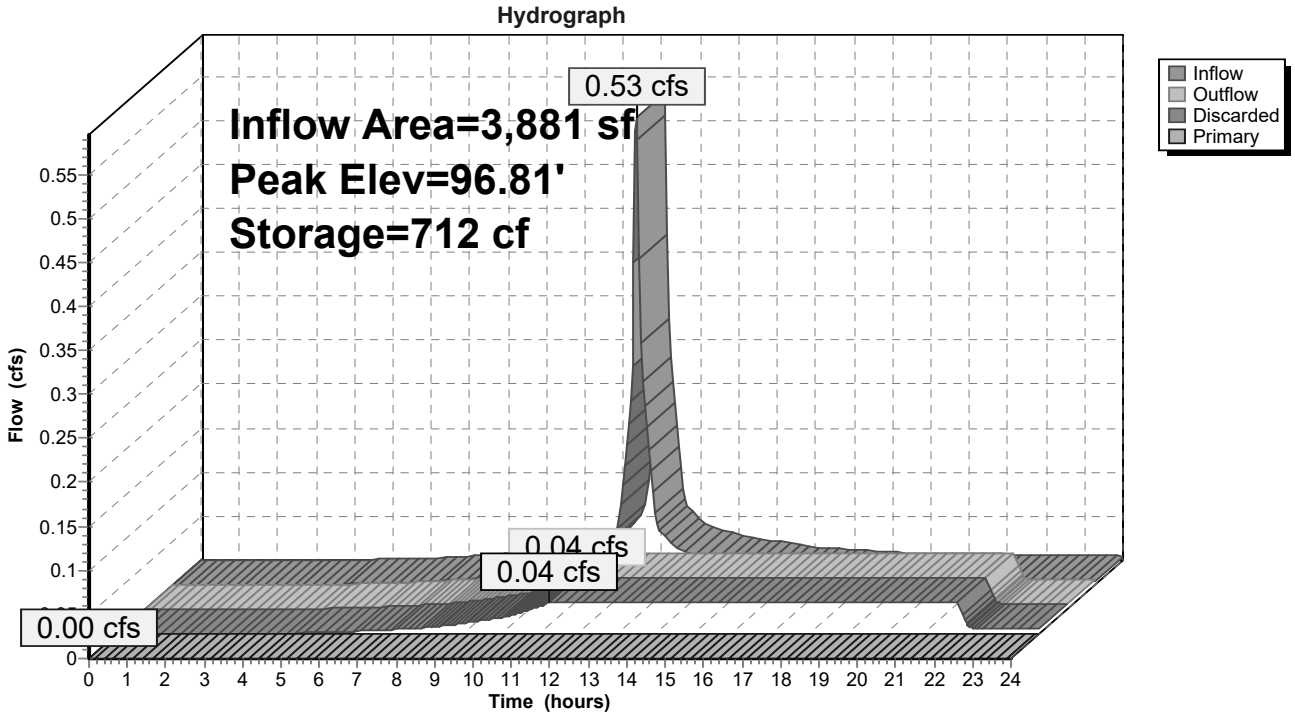
2,324.2 cf Field - 879.2 cf Chambers = 1,445.0 cf Stone x 40.0% Voids = 578.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,457.2 cf = 0.033 af
Overall Storage Efficiency = 62.7%
Overall System Size = 31.50' x 20.83' x 3.54'

16 Chambers
86.1 cy Field
53.5 cy Stone



Pond 3P: Cultec 330XL HD



Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment PWS-1: PWS-1 Runoff Area=14,968 sf 88.88% Impervious Runoff Depth>7.39"
Tc=5.0 min CN=91 Runoff=2.77 cfs 9,212 cf

Subcatchment PWS-2: PWS-2 Runoff Area=3,444 sf 10.80% Impervious Runoff Depth>1.99"
Tc=5.0 min CN=45 Runoff=0.16 cfs 570 cf

Subcatchment PWS-3: PWS-3 Runoff Area=3,881 sf 85.24% Impervious Runoff Depth>7.14"
Tc=5.0 min CN=89 Runoff=0.70 cfs 2,311 cf

Subcatchment PWS-4: PWS-4 Runoff Area=1,367 sf 0.00% Impervious Runoff Depth>1.36"
Tc=5.0 min CN=39 Runoff=0.04 cfs 155 cf

Reach DP-1: Hillside Ave (east) Inflow=0.16 cfs 570 cf
Outflow=0.16 cfs 570 cf

Reach DP-2: Allenclair Drive Inflow=0.04 cfs 155 cf
Outflow=0.04 cfs 155 cf

Pond 1P: Cultec 330XL HD Peak Elev=97.79' Storage=4,486 cf Inflow=2.77 cfs 9,212 cf
Discarded=0.13 cfs 7,255 cf Primary=0.00 cfs 0 cf Outflow=0.13 cfs 7,255 cf

Pond 3P: Cultec 330XL HD Peak Elev=97.54' Storage=1,068 cf Inflow=0.70 cfs 2,311 cf
Discarded=0.04 cfs 2,048 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 2,048 cf

Total Runoff Area = 23,660 sf Runoff Volume = 12,247 cf Average Runoff Depth = 6.21"
28.22% Pervious = 6,676 sf 71.78% Impervious = 16,984 sf

Summary for Subcatchment PWS-1: PWS-1

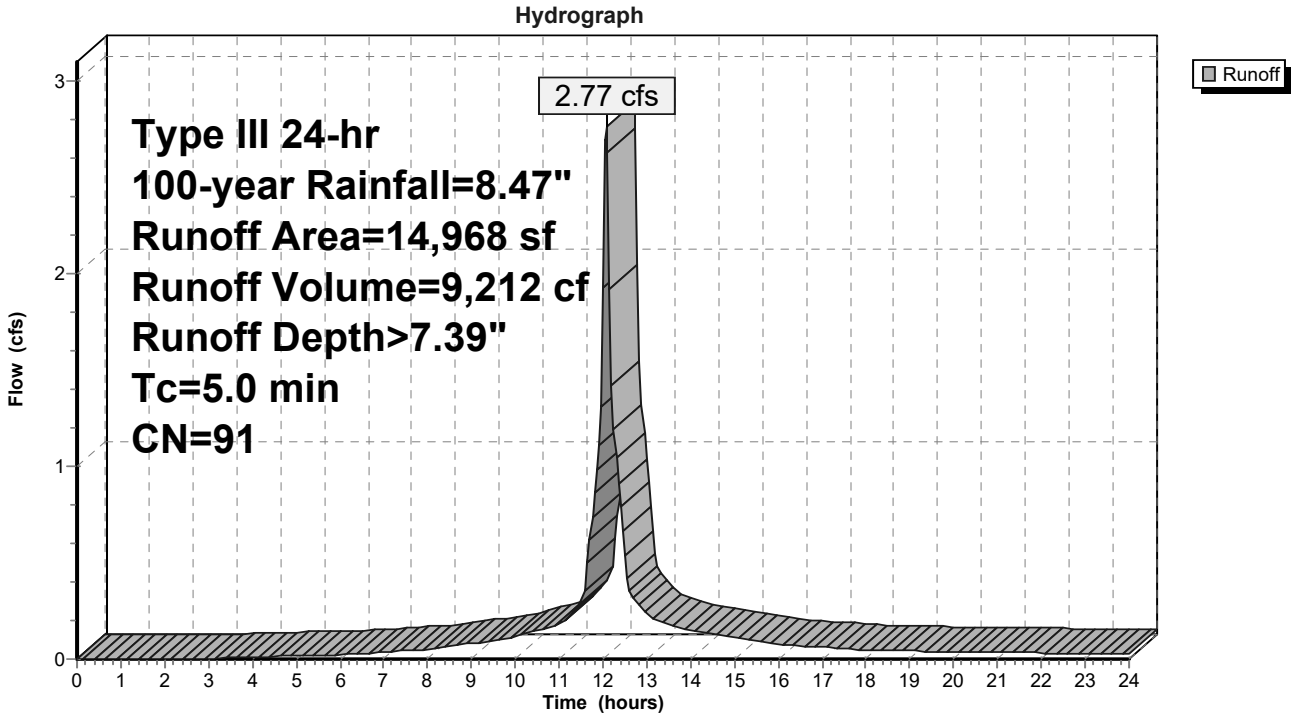
Runoff = 2.77 cfs @ 12.07 hrs, Volume= 9,212 cf, Depth> 7.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.47"

Area (sf)	CN	Description
8,635	98	Paved parking, HSG A
4,669	98	Roofs, HSG A
1,664	39	>75% Grass cover, Good, HSG A
14,968	91	Weighted Average
1,664		11.12% Pervious Area
13,304		88.88% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-1: PWS-1



Summary for Subcatchment PWS-2: PWS-2

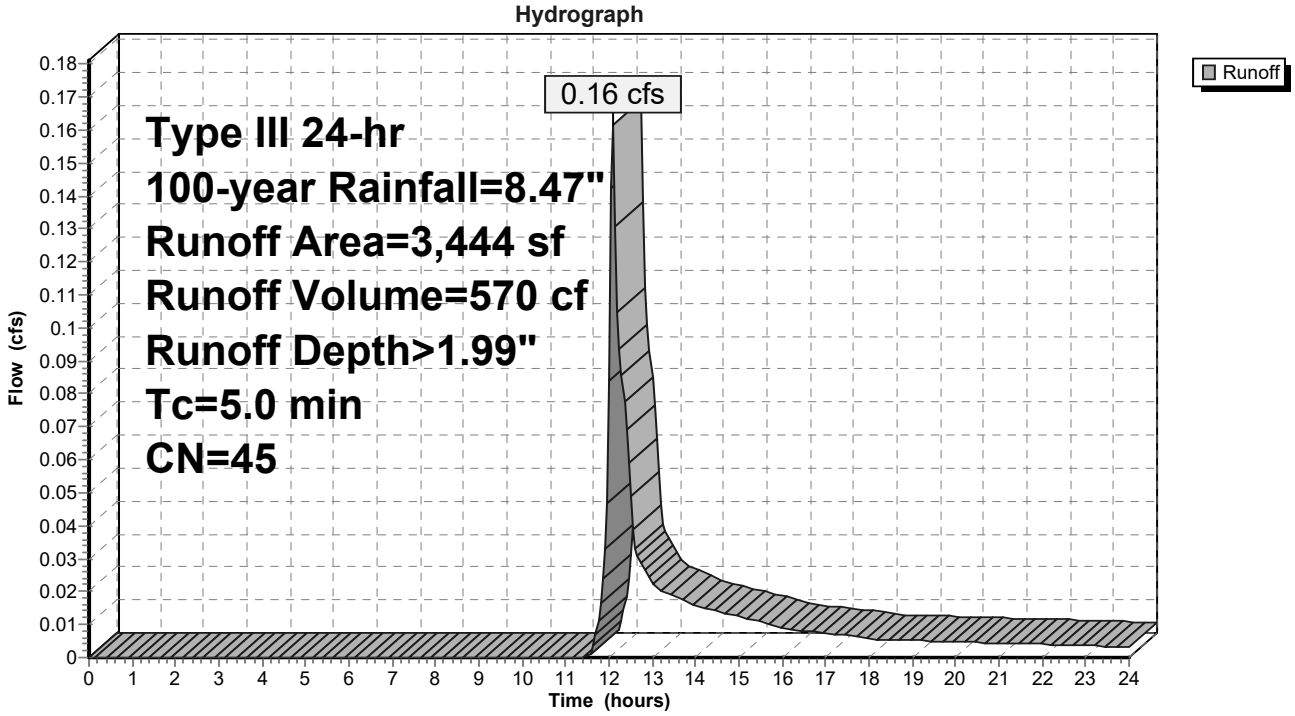
Runoff = 0.16 cfs @ 12.09 hrs, Volume= 570 cf, Depth> 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.47"

Area (sf)	CN	Description
3,072	39	>75% Grass cover, Good, HSG A
372	98	Paved roads w/curbs & sewers, HSG A
3,444	45	Weighted Average
3,072		89.20% Pervious Area
372		10.80% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-2: PWS-2



Summary for Subcatchment PWS-3: PWS-3

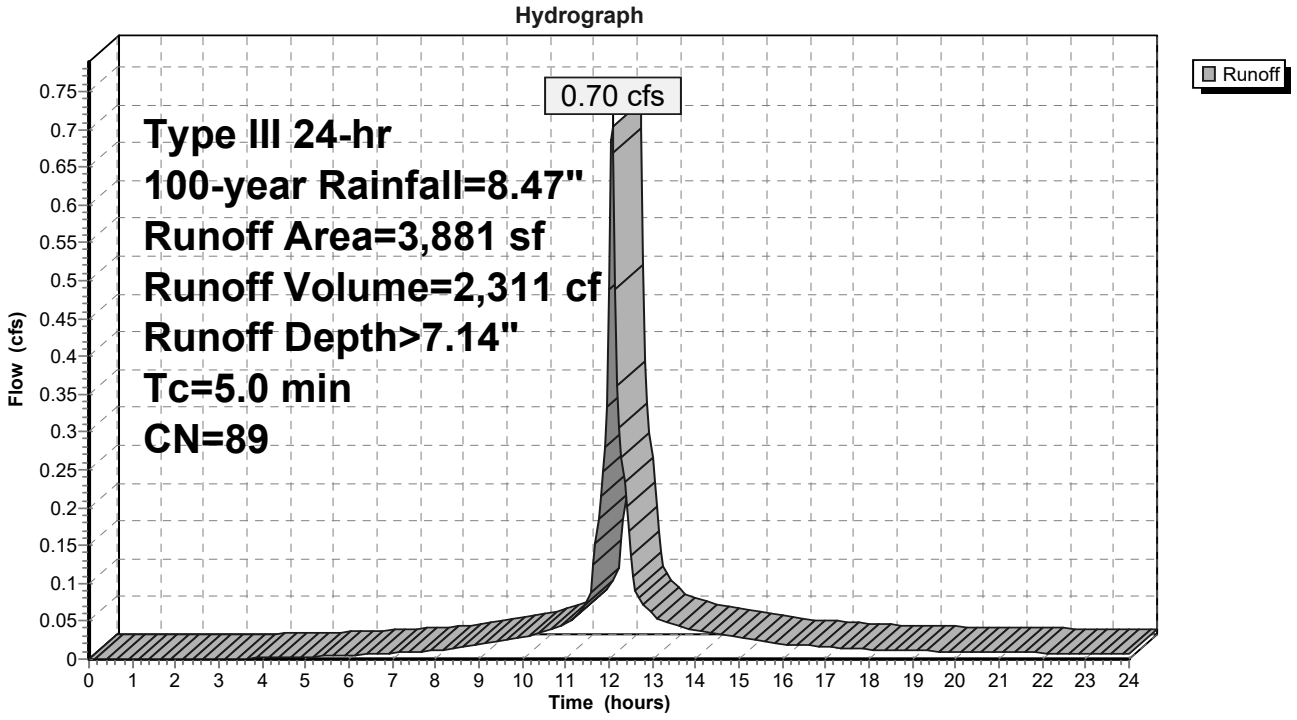
Runoff = 0.70 cfs @ 12.07 hrs, Volume= 2,311 cf, Depth> 7.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.47"

	Area (sf)	CN	Description
	573	39	>75% Grass cover, Good, HSG A
	3,290	98	Paved parking, HSG A
*	18	98	Walk, HSG A
	3,881	89	Weighted Average
	573		14.76% Pervious Area
	3,308		85.24% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-3: PWS-3



Summary for Subcatchment PWS-4: PWS-4

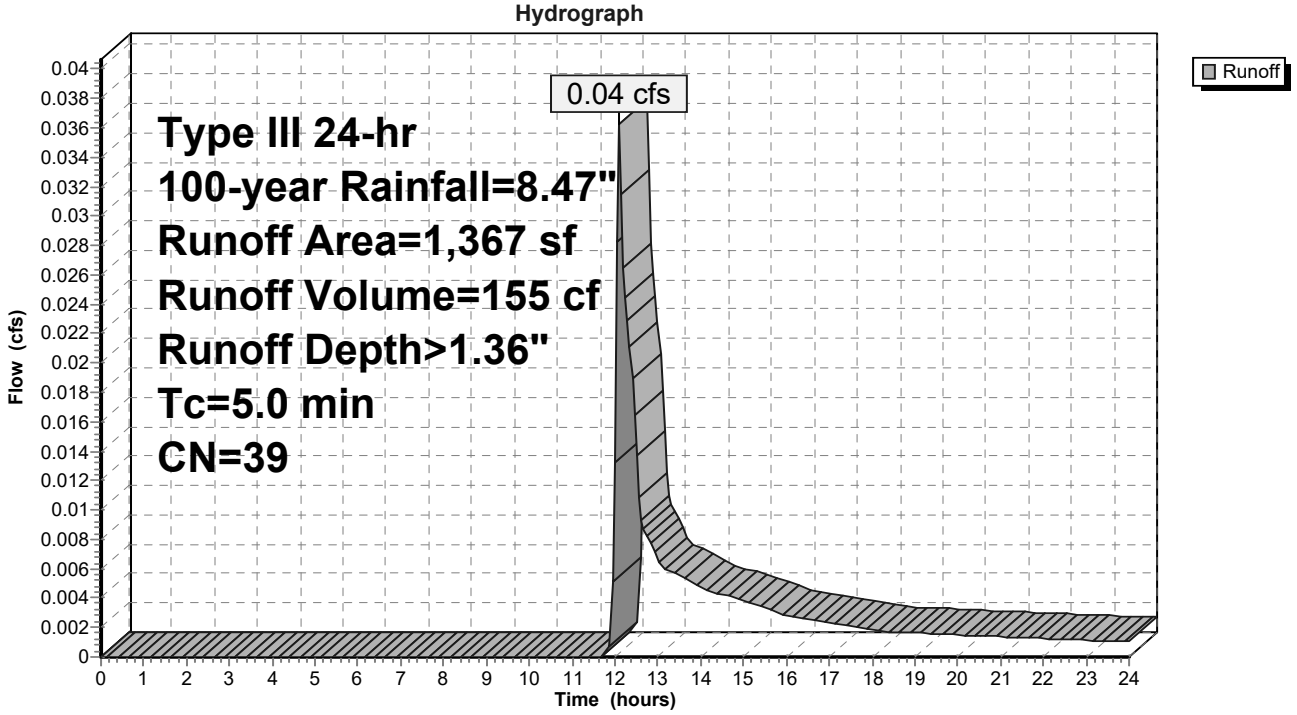
Runoff = 0.04 cfs @ 12.11 hrs, Volume= 155 cf, Depth> 1.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.47"

Area (sf)	CN	Description
1,367	39	>75% Grass cover, Good, HSG A
1,367		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment PWS-4: PWS-4

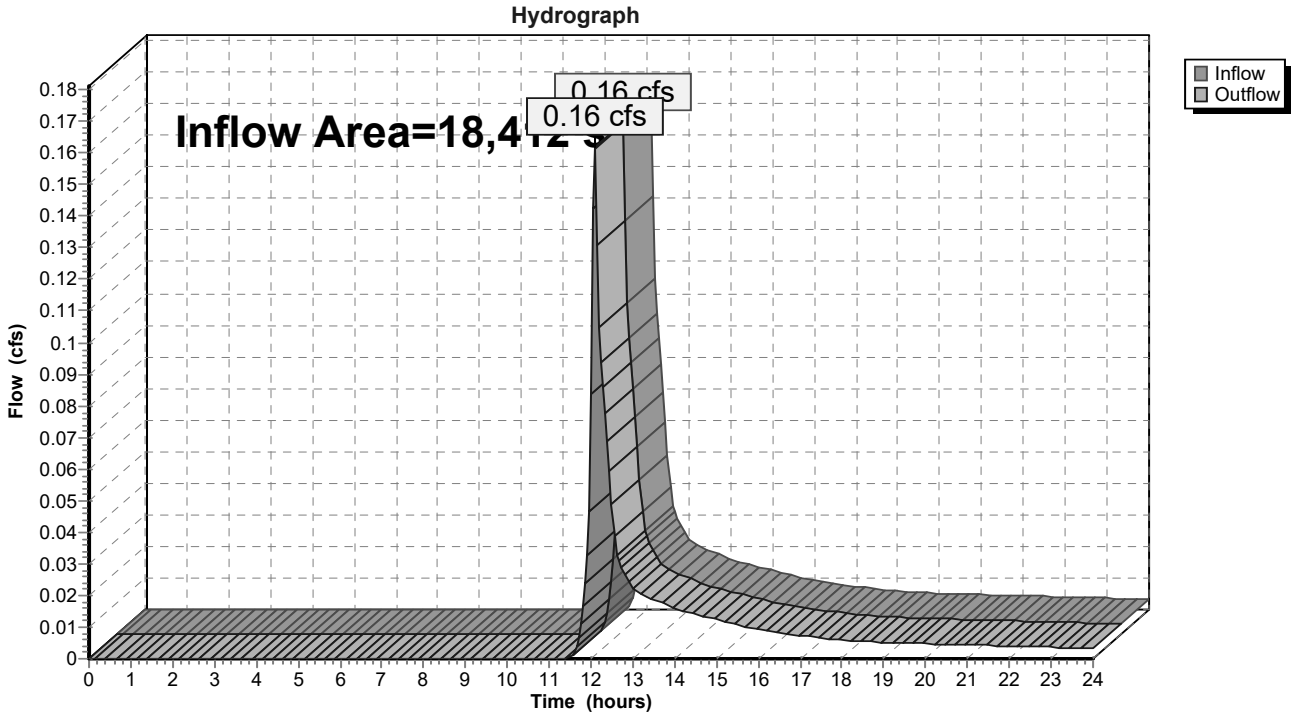


Summary for Reach DP-1: Hillside Ave (east)

Inflow Area = 18,412 sf, 74.28% Impervious, Inflow Depth > 0.37" for 100-year event
Inflow = 0.16 cfs @ 12.09 hrs, Volume= 570 cf
Outflow = 0.16 cfs @ 12.09 hrs, Volume= 570 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-1: Hillside Ave (east)

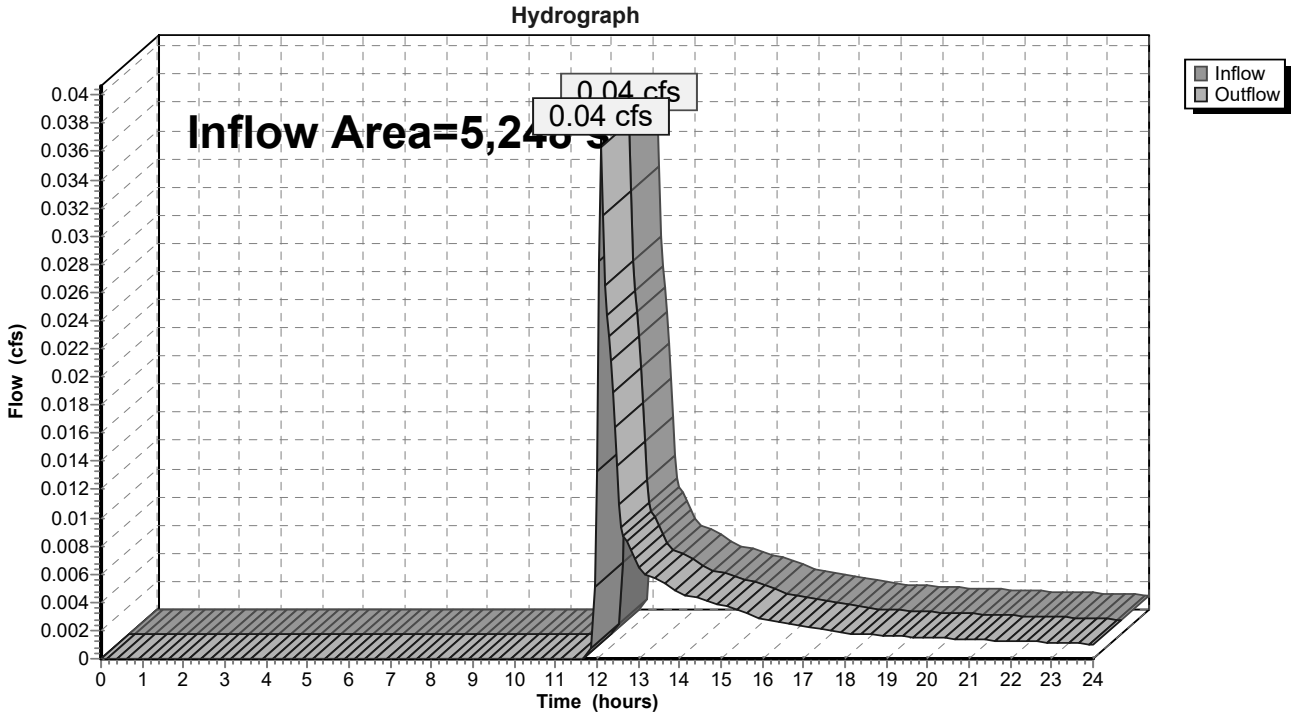


Summary for Reach DP-2: Allenclair Drive

Inflow Area = 5,248 sf, 63.03% Impervious, Inflow Depth > 0.35" for 100-year event
Inflow = 0.04 cfs @ 12.11 hrs, Volume= 155 cf
Outflow = 0.04 cfs @ 12.11 hrs, Volume= 155 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach DP-2: Allenclair Drive



Summary for Pond 1P: Cultec 330XL HD

Inflow Area = 14,968 sf, 88.88% Impervious, Inflow Depth > 7.39" for 100-year event
Inflow = 2.77 cfs @ 12.07 hrs, Volume= 9,212 cf
Outflow = 0.13 cfs @ 10.30 hrs, Volume= 7,255 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.13 cfs @ 10.30 hrs, Volume= 7,255 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 97.79' @ 14.57 hrs Surf.Area= 2,242 sf Storage= 4,486 cf

Plug-Flow detention time= 258.6 min calculated for 7,255 cf (79% of inflow)
Center-of-Mass det. time= 180.8 min (950.5 - 769.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	94.91'	1,897 cf	**30.50'W x 73.50'L x 3.54'H Field A** 7,940 cf Overall - 3,196 cf Embedded = 4,743 cf x 40.0% Voids
#2A	95.41'	3,196 cf	**Cultec R-330XLHD** x 60 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 6 rows
#3	98.45'	0 cf	**0.50'D x 1.77'H Vertical Cone/Cylinder**-Impervious
		5,094 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	94.91'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	100.21'	**6.0" Vert. Orifice/Grate X 3.00** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.13 cfs @ 10.30 hrs HW=94.97' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.13 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=94.91' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Cultec 330XL HD - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 6 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

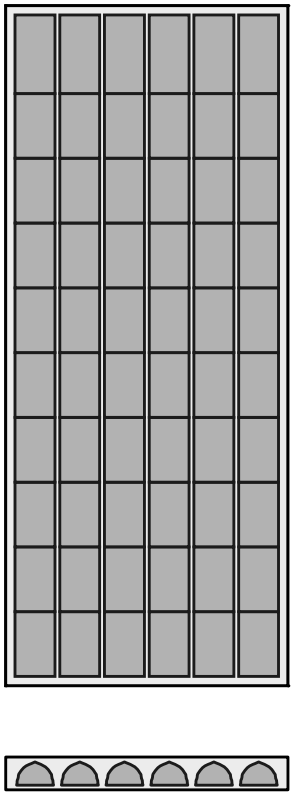
10 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 71.50' Row Length +12.0" End Stone x 2 = 73.50' Base Length
6 Rows x 52.0" Wide + 6.0" Spacing x 5 + 12.0" Side Stone x 2 = 30.50' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

60 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 6 Rows = 3,196.5 cf Chamber Storage

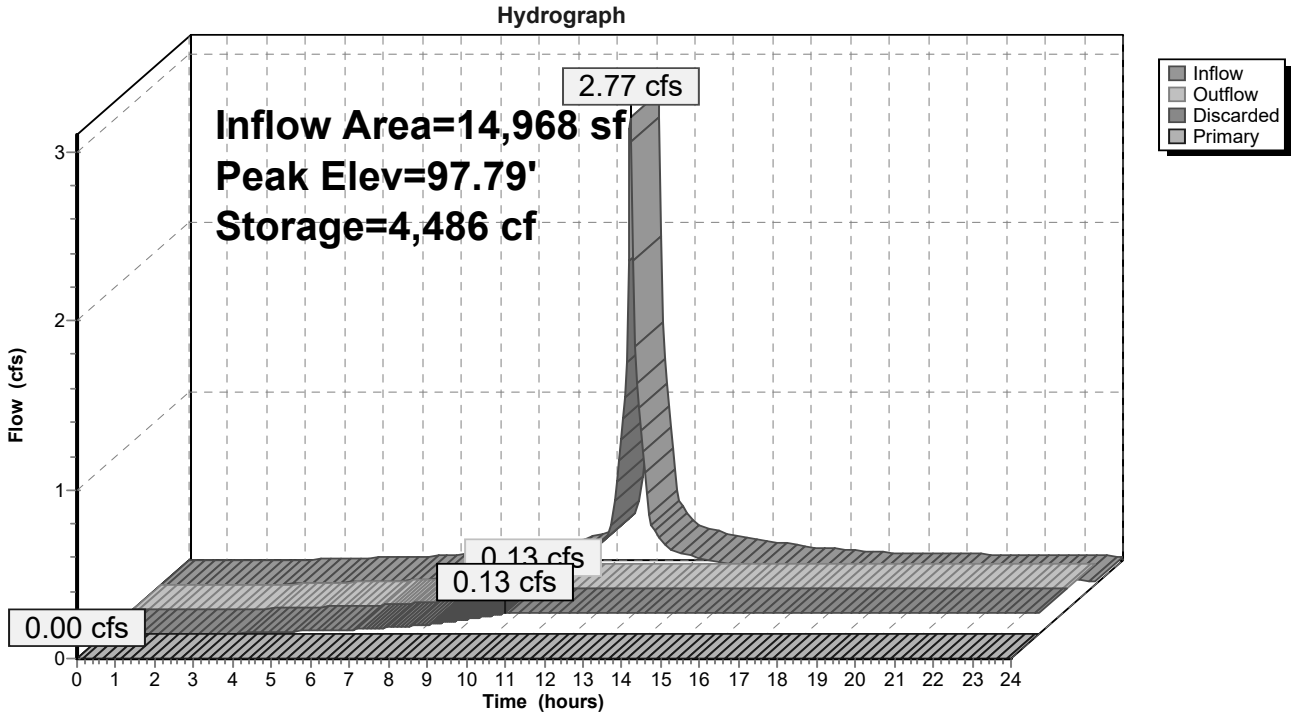
7,939.5 cf Field - 3,196.5 cf Chambers = 4,743.1 cf Stone x 40.0% Voids = 1,897.2 cf Stone Storage

Chamber Storage + Stone Storage = 5,093.7 cf = 0.117 af
Overall Storage Efficiency = 64.2%
Overall System Size = 73.50' x 30.50' x 3.54'

60 Chambers
294.1 cy Field
175.7 cy Stone



Pond 1P: Cultec 330XL HD



Summary for Pond 3P: Cultec 330XL HD

Inflow Area = 3,881 sf, 85.24% Impervious, Inflow Depth > 7.14" for 100-year event
Inflow = 0.70 cfs @ 12.07 hrs, Volume= 2,311 cf
Outflow = 0.04 cfs @ 10.65 hrs, Volume= 2,048 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.04 cfs @ 10.65 hrs, Volume= 2,048 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 97.54' @ 14.07 hrs Surf.Area= 656 sf Storage= 1,068 cf

Plug-Flow detention time= 245.2 min calculated for 2,043 cf (88% of inflow)
Center-of-Mass det. time= 192.4 min (968.4 - 776.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	95.21'	578 cf	**20.83'W x 31.50'L x 3.54'H Field A** 2,324 cf Overall - 879 cf Embedded = 1,445 cf x 40.0% Voids
#2A	95.71'	879 cf	**Cultec R-330XLHD** x 16 Inside #1 Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap Row Length Adjustment= +1.50' x 7.45 sf x 4 rows
#3	98.80'	0 cf	**0.50'D x 1.08'H Vertical Cone/Cylinder**-Impervious
		1,457 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	95.21'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	99.83'	**6.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 10.65 hrs HW=95.26' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.21' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 3P: Cultec 330XL HD - Chamber Wizard Field A

Chamber Model = Cultec R-330XLHD (Cultec Recharger® 330XLHD)
Effective Size= 47.8"W x 30.0"H => 7.45 sf x 7.00'L = 52.2 cf
Overall Size= 52.0"W x 30.5"H x 8.50'L with 1.50' Overlap
Row Length Adjustment= +1.50' x 7.45 sf x 4 rows

52.0" Wide + 6.0" Spacing = 58.0" C-C Row Spacing

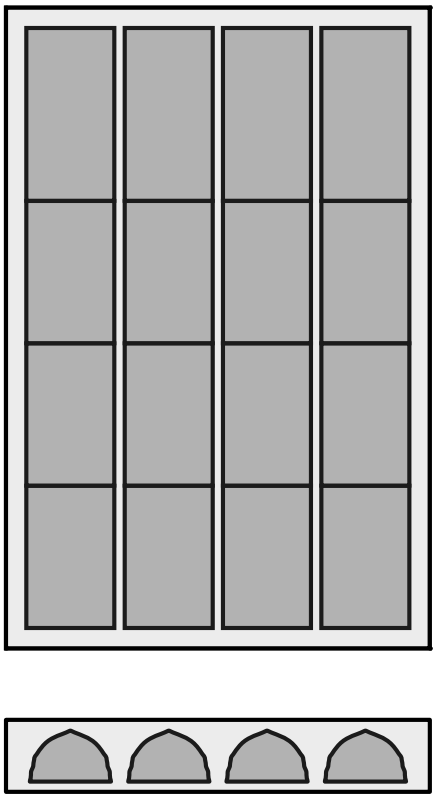
4 Chambers/Row x 7.00' Long +1.50' Row Adjustment = 29.50' Row Length +12.0" End Stone x 2 = 31.50' Base Length
4 Rows x 52.0" Wide + 6.0" Spacing x 3 + 12.0" Side Stone x 2 = 20.83' Base Width
6.0" Stone Base + 30.5" Chamber Height + 6.0" Stone Cover = 3.54' Field Height

16 Chambers x 52.2 cf +1.50' Row Adjustment x 7.45 sf x 4 Rows = 879.2 cf Chamber Storage

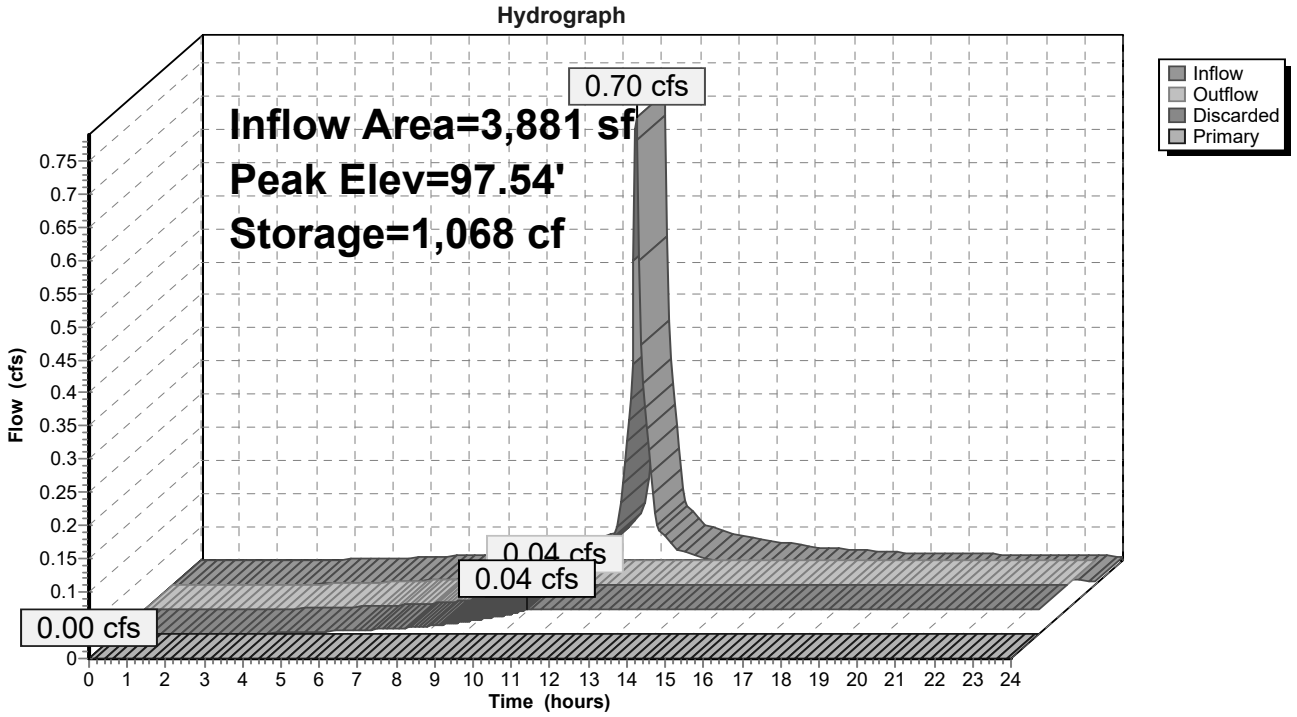
2,324.2 cf Field - 879.2 cf Chambers = 1,445.0 cf Stone x 40.0% Voids = 578.0 cf Stone Storage

Chamber Storage + Stone Storage = 1,457.2 cf = 0.033 af
Overall Storage Efficiency = 62.7%
Overall System Size = 31.50' x 20.83' x 3.54'

16 Chambers
86.1 cy Field
53.5 cy Stone

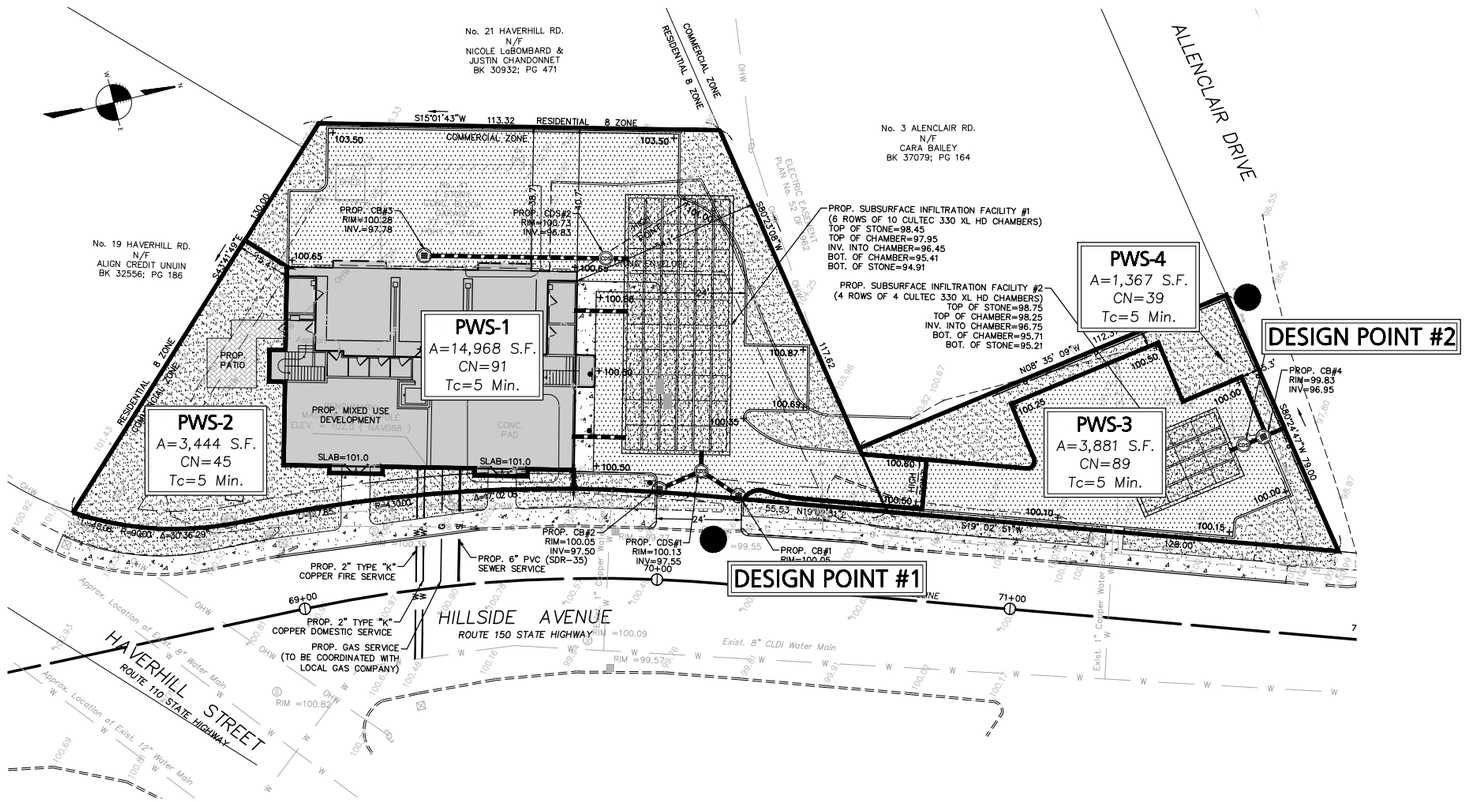


Pond 3P: Cultec 330XL HD



LEGEND - GRADING,DRAINAGE, & UTILITY

PROPERTY LINE	
PROPOSED BUILDING	
PROPOSED DRAIN LINE	
PROPOSED CATCH BASIN	
PROPOSED CDS UNIT W/GRATE	
PROPOSED DRAIN MANHOLE	
PROPOSED CDS UNIT	
PROPOSED SEWER LINE	S
PROPOSED SEWER MANHOLE	
PROPOSED PUMP CHAMBER	
PROPOSED GAS TRAP	
PROPOSED WATER LINE	W
PROPOSED GAS LINE	G
PROPOSED ELECTRIC LINE	E
PROPOSED TRANSFORMER	T
PROPOSED CONTOUR	18
PROPOSED SPOT SHOT	15.57



GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

DESCRIPTION OF REVISION	DATE

PREPARED BY:

Engineering Alliance, Inc.
Civil Engineering & Land Planning Consultants
1950 Lafayette Road
194 Central Street
Saugus, MA 01906
Portsmouth, NH 03801
Tel: (781) 231-1349
Tel: (603) 610-7100
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Fax: (603) 6107101

PROJECT:
Site Development Plan
39 & 41 Hillside Avenue
Amesbury, Massachusetts

PROJECT #: 21-76801 | DATE: October 26, 2021
SCALE: AS NOTED | DWG FILE NAME: 21-76801.dwg
DESIGN BY: Max Friedman | CHECKED BY: Richard A. Salvo P.E.

RICHARD A. SALVO
No. 41861
REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF MASSACHUSETTS

Professional Engineer for Engineering Alliance, Inc.

OWNER:
Angiolillo Management Group Inc.
99 Walnut Street
Saugus, MA 01906

DWG. NO.: PWS

DRAWING TITLE:
Proposed Watershed Plan

APPENDIX C

Best Management Practices Maintenance Plan

BEST MANAGEMENT PRACTICES OPERATIONS AND MAINTENANCE PLAN

for the

Proposed Mixed-Use Development

located at

39 & 41 Hillside Avenue
(Tax Map 76 Lots 60 & 61)
Amesbury, Massachusetts

Submitted to:

City of Amesbury
City Hall
62 Friend Street
Amesbury, MA 01913

Prepared for:

Angiolillo Management Group Inc.
99 Walnut Street
Saugus, MA 01906

Prepared by:

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June 7, 2021

BEST MANAGEMENT PRACTICES OPERATIONS AND MAINTENANCE PLAN

A Best Management Practices Operations and Maintenance Plan is summarized below and will be incorporated into the construction documents for this project.

In accordance with the Storm Water Management Regulations issued by the Department of Environmental Protection (DEP), Engineering Alliance, Inc. has prepared the following best management practices maintenance plan for the proposed development located at 39 & 41 Hillside Avenue (Tax Map 76 Lots 60 & 61) in Amesbury, Massachusetts. The following information is broken into three sections: Construction Activities, Maintenance Budget, and Post Development Operation & Maintenance.

Basic Information

Owner: Angiolillo Management Group Inc.
99 Walnut Street
Saugus, MA 01906

Section 1 - Construction Activities

1. Contact the Amesbury Planning Department at least three (3) days prior to start of construction.

2. Install haybales and silt fence as required and silt sacs in existing catch basins in close proximity to the work to prevent sediment from entering the closed drainage system and down gradient resource areas.

3. The contractor shall only disturb the minimum area necessary.

4. The entire project area shall be swept upon completion of construction and prior to removal of the erosion control devices.

Section 2 – Maintenance Budget

It is anticipated that maintenance will be required for both the temporary and permanent storm water controls. A budget shall be set aside by the contractor/owner as follows:

Construction Activities: A sum of $2,500 shall be set aside to periodically replace temporary stormwater measures throughout all construction activities.

Post Development Construction Activities: A compounding annual budget of $500 shall be set aside to maintain and/or replace the subsurface infiltration facilities and all other stormwater infrastructure as necessary.

Section 3 – Post Development Operation & Maintenance

1. Paved Areas (Bituminous Concrete) - Paved areas shall be swept by street sweepers periodically during dry weather to remove excess sediments, reducing the amount of sediments that the drainage system will have to remove from the runoff. Salt for de-icing on the paved areas during the winter months should be limited as much as possible, as this will reduce the need for removal and treatment. Sand containing the minimum amount of calcium chloride (or approved equivalent) needed for handling may be applied as part of the routine winter maintenance activities. **At a minimum all paved areas must be swept two times annually: once in the fall and once in the spring.**

2. Cultec Sub-Surface Infiltration Facilities – Cultec Subsurface Infiltration facilities are equipped with an inspection port in each row. When the lid is removed, a screw in-plug will be exposed. Remove the plug and measure depth of sediment. If the sediment exceeds 3 inches in depth, the row should be cleaned with high pressure water through a culvert cleaning nozzle. Inlets should be periodically maintained to prevent clogging and maintain infiltration capacity.

   After installation, the system should be inspected immediately after the first storm event exceeding 1’ in depth to ensure proper functionality. The system should otherwise be inspected at a minimum of two times annually: one in the fall and once in the spring.

3. Catch Basins – Catch basins shall be inspected monthly for the initial twelve-month period following the completion of the construction of the paved areas. Debris shall be removed from the catch basin grates, sumps and outlet pipes and disposed of in compliance with local, state and federal guidelines.

   Upon a period beginning twelve months after the completion of the site, all catch basins shall be inspected and maintained twice annually, once in April and once in November. Debris shall be removed from the catch basin grates, sumps and outlet pipes and disposed of in compliance with local, state and federal guidelines.

4. Contech CDS Units (Water Quality Manholes): Contech CDS units with manhole cover should be maintained bi-annually, after a large rain event, and when sediment levels exceed maintenance volumes, as required by the manufacturer. At a minimum, water quality manhole shall be serviced every spring and fall.

5. Snow removal and storage - Plowed snow shall be placed in the pervious area located between the parking area and property line, where it can slowly infiltrate. Sediments shall be removed from this area every spring. The storage of snow is **not** permitted in any Storm Water Facilities When the amount of snow exceeds the capacity of the snow storage areas, it shall be removed from the site and disposed of properly immediately after each storm at the owner's expense. Refer to the proposed site plan for designated snow storage areas.

6. Pesticides, Herbicides, and Fertilizers **-** Pesticides and herbicides shall not be used within the limits of the 100-foot buffer zone to any wetland resource areas as defined under 310 CMR 10.00. In addition, fertilizers that are used within this zone should be restricted to the use of organic fertilizers only.

7. Maintenance Responsibilities **-** All post construction maintenance activities should be documented and kept on file and made available to the City of Amesbury upon request. All post construction maintenance activities shall run with the title of the property.

NOAA Atlas 14, Volume 10, Version 3
Location name: Amesbury, Massachusetts, USA*
Latitude: 42.8454°, Longitude: -70.9371°
Elevation: 100.37 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.315** (0.253-0.393)	**0.377** (0.302-0.471)	**0.479** (0.383-0.601)	**0.563** (0.446-0.709)	**0.679** (0.518-0.890)	**0.766** (0.572-1.02)	**0.857** (0.618-1.19)	**0.958** (0.652-1.35)	**1.10** (0.717-1.61)	**1.22** (0.772-1.81)
10-min	**0.446** (0.358-0.557)	**0.534** (0.428-0.668)	**0.678** (0.541-0.850)	**0.797** (0.632-1.00)	**0.961** (0.734-1.26)	**1.09** (0.809-1.45)	**1.21** (0.875-1.68)	**1.36** (0.922-1.92)	**1.56** (1.02-2.28)	**1.73** (1.09-2.57)
15-min	**0.525** (0.421-0.655)	**0.628** (0.504-0.785)	**0.797** (0.637-1.00)	**0.938** (0.744-1.18)	**1.13** (0.864-1.48)	**1.28** (0.953-1.71)	**1.43** (1.03-1.98)	**1.60** (1.09-2.26)	**1.84** (1.20-2.68)	**2.03** (1.29-3.02)
30-min	**0.720** (0.578-0.899)	**0.862** (0.691-1.08)	**1.09** (0.873-1.37)	**1.29** (1.02-1.62)	**1.55** (1.19-2.03)	**1.75** (1.31-2.34)	**1.96** (1.41-2.71)	**2.19** (1.49-3.09)	**2.52** (1.64-3.68)	**2.79** (1.76-4.14)
60-min	**0.915** (0.734-1.14)	**1.10** (0.878-1.37)	**1.39** (1.11-1.74)	**1.63** (1.30-2.06)	**1.97** (1.51-2.59)	**2.23** (1.66-2.98)	**2.49** (1.79-3.44)	**2.78** (1.89-3.93)	**3.20** (2.08-4.67)	**3.54** (2.24-5.26)
2-hr	**1.20** (0.969-1.49)	**1.44** (1.17-1.79)	**1.84** (1.48-2.30)	**2.17** (1.74-2.73)	**2.63** (2.03-3.45)	**2.97** (2.24-3.97)	**3.34** (2.44-4.63)	**3.77** (2.57-5.30)	**4.42** (2.88-6.41)	**4.97** (3.16-7.35)
3-hr	**1.40** (1.14-1.73)	**1.69** (1.37-2.09)	**2.17** (1.75-2.69)	**2.56** (2.06-3.20)	**3.11** (2.40-4.06)	**3.51** (2.66-4.69)	**3.95** (2.90-5.48)	**4.48** (3.06-6.27)	**5.29** (3.46-7.65)	**5.99** (3.81-8.82)
6-hr	**1.81** (1.48-2.23)	**2.20** (1.80-2.71)	**2.84** (2.31-3.50)	**3.36** (2.71-4.17)	**4.09** (3.19-5.31)	**4.62** (3.52-6.14)	**5.21** (3.85-7.20)	**5.93** (4.06-8.24)	**7.04** (4.61-10.1)	**8.00** (5.10-11.7)
12-hr	**2.30** (1.89-2.80)	**2.81** (2.31-3.43)	**3.64** (2.98-4.46)	**4.33** (3.52-5.33)	**5.28** (4.14-6.81)	**5.98** (4.58-7.89)	**6.74** (5.01-9.26)	**7.68** (5.28-10.6)	**9.12** (6.00-13.0)	**10.4** (6.63-15.0)
24-hr	**2.72** (2.26-3.30)	**3.38** (2.80-4.10)	**4.46** (3.67-5.42)	**5.35** (4.38-6.54)	**6.58** (5.19-8.45)	**7.48** (5.77-9.83)	**8.47** (6.34-11.6)	**9.71** (6.70-13.3)	**11.6** (7.68-16.5)	**13.3** (8.56-19.2)
2-day	**3.04** (2.54-3.66)	**3.86** (3.22-4.65)	**5.20** (4.31-6.28)	**6.30** (5.19-7.66)	**7.83** (6.23-10.0)	**8.94** (6.96-11.7)	**10.2** (7.71-14.0)	**11.8** (8.16-16.1)	**14.4** (9.51-20.3)	**16.7** (10.7-23.9)
3-day	**3.32** (2.78-3.98)	**4.19** (3.51-5.03)	**5.62** (4.68-6.77)	**6.81** (5.63-8.24)	**8.45** (6.75-10.8)	**9.64** (7.53-12.6)	**11.0** (8.34-15.0)	**12.7** (8.82-17.3)	**15.5** (10.3-21.8)	**18.1** (11.7-25.8)
4-day	**3.58** (3.01-4.29)	**4.49** (3.76-5.37)	**5.96** (4.98-7.16)	**7.18** (5.96-8.67)	**8.86** (7.10-11.3)	**10.1** (7.90-13.2)	**11.5** (8.73-15.6)	**13.3** (9.22-18.0)	**16.2** (10.7-22.6)	**18.8** (12.1-26.7)
7-day	**4.34** (3.67-5.16)	**5.27** (4.45-6.27)	**6.79** (5.71-8.11)	**8.05** (6.72-9.67)	**9.79** (7.88-12.4)	**11.1** (8.70-14.3)	**12.5** (9.52-16.9)	**14.3** (10.00-19.3)	**17.3** (11.5-24.1)	**20.0** (12.9-28.3)
10-day	**5.04** (4.27-5.97)	**5.99** (5.08-7.11)	**7.55** (6.37-8.99)	**8.85** (7.40-10.6)	**10.6** (8.57-13.3)	**11.9** (9.40-15.3)	**13.4** (10.2-17.9)	**15.2** (10.7-20.4)	**18.2** (12.1-25.2)	**20.8** (13.5-29.3)
20-day	**7.04** (6.02-8.29)	**8.09** (6.90-9.53)	**9.81** (8.33-11.6)	**11.2** (9.47-13.3)	**13.2** (10.7-16.3)	**14.7** (11.5-18.5)	**16.2** (12.3-21.2)	**18.0** (12.7-24.0)	**20.7** (13.9-28.4)	**22.9** (14.9-32.0)
30-day	**8.71** (7.47-10.2)	**9.84** (8.43-11.5)	**11.7** (9.96-13.8)	**13.2** (11.2-15.6)	**15.3** (12.4-18.8)	**16.9** (13.3-21.1)	**18.6** (14.0-23.9)	**20.3** (14.4-26.9)	**22.7** (15.3-31.1)	**24.6** (16.1-34.4)
45-day	**10.8** (9.32-12.6)	**12.0** (10.4-14.1)	**14.0** (12.0-16.4)	**15.7** (13.3-18.5)	**18.0** (14.6-21.8)	**19.7** (15.5-24.4)	**21.5** (16.1-27.3)	**23.2** (16.5-30.5)	**25.4** (17.2-34.6)	**27.0** (17.6-37.5)
60-day	**12.6** (10.9-14.7)	**13.9** (12.0-16.2)	**16.0** (13.7-18.7)	**17.7** (15.1-20.8)	**20.1** (16.4-24.4)	**22.0** (17.4-27.1)	**23.8** (17.9-30.1)	**25.6** (18.2-33.5)	**27.7** (18.8-37.5)	**29.2** (19.1-40.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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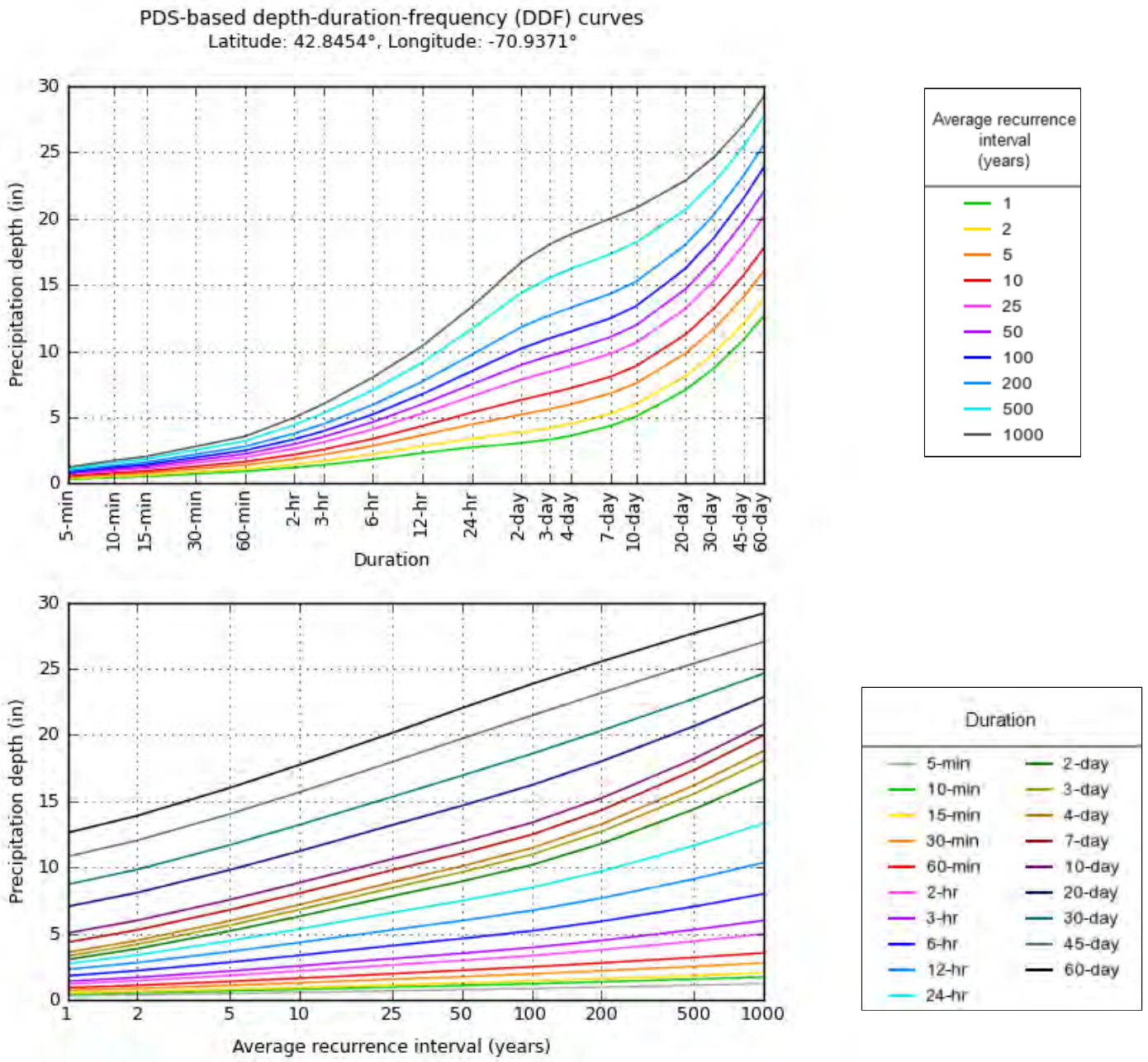
PF graphical



NOAA Atlas 14, Volume 10, Version 3

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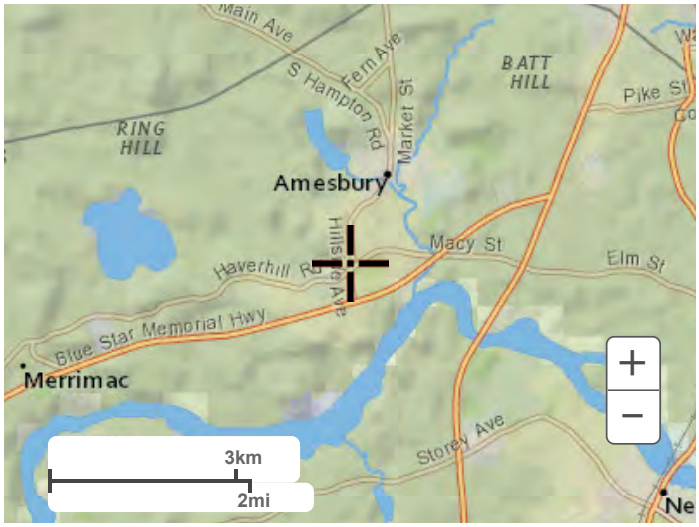
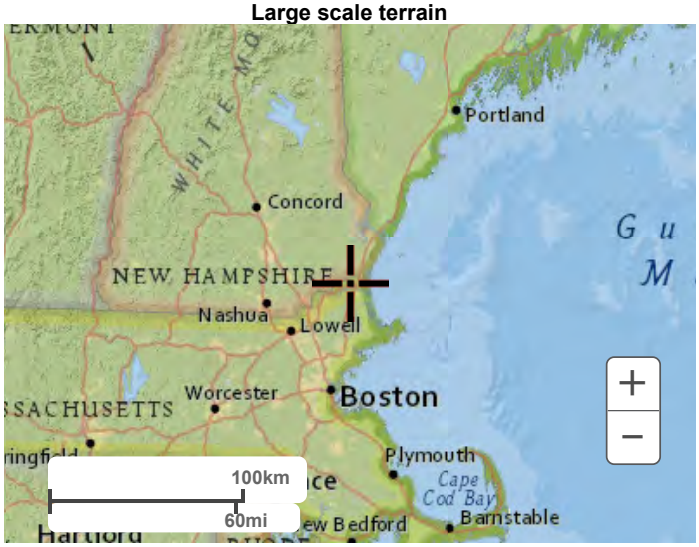
Maps & aerials

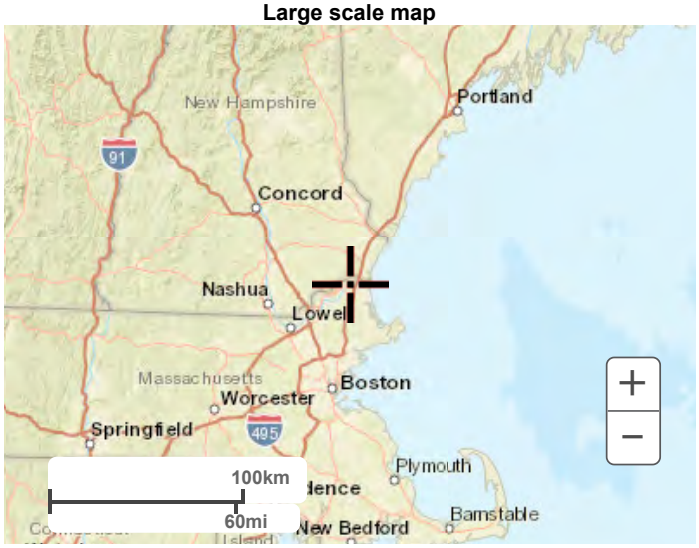
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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